The Chemical Age

A Weekly Journal Devoted to Industrial and Engineering Chemistry

VOL. X. No. 263 JUNE 28, 1924 Prepaid Annual Subscription United Kingdom, £1.1.0; Abroad, £1.6.0.

Contents.

NOTICES.—All communications relating to editorial matter should be addressed to the Editor, who will be pleased to consider articles or contributions dealing with modern chemical developments or suggestions bearing upon the advancement of the chemical industry in this country. Communications relating to advertisements or general matters should be addressed to the Manager.

The prepaid subscription to THE CHEMICAL AGE *is 21s. per annum for the United Kingdom, and 26s. abroad. Cheques, Money Orders and Postal Orders should be made payable to Benn Brothers, Ltd.*

Editorial and General Offices—8, Bouverie St., London, E.C.4.
Telegrams: "Allangas, Fleet, London." Telephone: City 9852 (6 lines)

The Heavy Chemical Industry

THIS issue deals with the subject of heavy acids and alkalis, which necessarily turns one's thoughts to almost the whole of the heavy chemical industry, which, as Mr. Rex Furness says in his pamphlet in the recently published Chemical Engineering Series, has always been deserving, both during the years of peace and in the strenuous times of war, of the highest tribute which can be paid. In the manufacture of the common acids, alkalis, bleaching agents, soaps, and so forth, this country still stands supreme, and no one would attempt to contest the national value of a flourishing heavy chemical industry—an industry which has always been, and must continue to be, a very considerable factor in the prosperity of this country. There are a host of chemicals classified under the broad but convenient title of "heavy chemicals" which are essential to the operation of British industries in general. Among these sulphuric acid claims first place, for it is difficult to find any modern industry into which it does not enter, directly, or indirectly, at some stage or another.

In recent issues of THE CHEMICAL AGE attention has been drawn to the modifications of plant which have been introduced within recent years, and which, from the point of view of capital expenditure, ground space, and ease of control, must offer an attractive prospect to all of those who may within the next few years be faced with renewals or extensions. The newer systems which introduce processes which are remarkable from the point of view of so-called "intensive working" have scarcely as yet found an opportunity for displaying their commercial and practical value in this country, for during the past few years there has been no call for the extension of plant. The year 1921 was one of remarkable depression, when the total production of sulphuric acid amounted to only some 550,000 tons, but since then a steady recovery has been experienced, and during the past year it was estimated that the output of this acid was about 300,000 tons in excess of the 1921 figure. We seem, in fact, to be definitely on the road towards full recovery, for business in many of the "consuming" industries is at least more stable and gives every indication of quick expansion.

In reviewing the situation so far as sulphuric acid manufacture is concerned, one cannot but be struck by the manner in which sulphur has within the past three or four years tended towards supplanting pyrites as a raw material. From the point of view of quality and after-treatment of the acid this is a policy which must commend itself to both producer and consumer, but it would not necessarily appear to bring much, if any, hope so far as the reduction of the price of acid is concerned.

In this issue Mr. P. Parrish writes with an authority born of practical experience on the absorbing problem of the production of caustic soda by electrolytic means. In another article Mr. P. Heigham traces the developments which have occurred within the comparatively short space of ten years in connection with the manufacture of neutral sulphate of ammonia, and his remarks lead one to suppose that possibly within a couple of years not a ton of the acid salt will be produced in this country.

Dyestuffs Debate in the Commons

IN Committee of the House of Commons last week, during the debate on the Civil Services and Revenue Departments Estimates, the question of the Anglo-German dyestuffs agreement was discussed in a more direct fashion than had been possible on any previous occasion, and other aspects of dyestuffs policy came in for incidental criticism. We regret that space does not permit of the reproduction of the speeches in particular, those, of Mr. Waddington, Mr. Black, Dr. Clayton and Mr. Spencer. Readers who desire the full text may be referred to *Hansard* for June 19. The most that is possible here is to summarise the situation as disclosed in the discussion.

Mr. Waddington put it very plainly to the Government that they ought now to be in a position to make a definite statement as to their policy, and to state the terms of the agreement so far as they are known. He asked for a pledge that before the Government did anything decisive the matter should be brought before

the House. He suggested that the two Government directors on the British Dyestuffs Corporation should resign and that there should be appointed in their place two directors "who would command the confidence of the users of the country." He asked for a definite assurance that the Government did not intend to repeal the Dyestuffs Act, because "while it has many imperfections and in its administration causes difficulties, yet it is fulfilling the purpose for which it was established." Finally, he gave figures to show that, instead of declining, the exports of printed and dyed goods in 1923 were 214,000,000 yards greater than in 1922, so that whatever was wrong with the textile industry it was not the dyes. Mr. Black followed this up by protesting against synthetic indigo coming into this country at 3½d. per lb. and being resold at 1s. 5d., while Continental competitors only paid 8d. or 9d. per lb. Mr. Black also made a strong plea for a merchant representative on the Dyestuffs Licensing Committee, and urged that if the B.D.C. under any agreement should become large selling agents rather than producers the Government should exercise its authority. Dr. Clayton declared himself most anxious that before the agreement was ratified the House should have ample opportunity of scrutinising it. Speaking as a chemist on behalf of research chemists, he urged the importance of research work being done in this country, and of free markets so that the industry might develop and be able to pay for research. If, he said, the dyes were made in Germany, all the intermediates and chemicals would be made there also instead of here, and the effect on chemists and chemical industry would be very serious. Speeches in a similar vein were made by Mr. Pringle and Mr. Spencer.

Mr. Webb's reply was a little pathetic. He was entitled to remind the House, as he did, that in this matter the Government were saddled with a legacy from their predecessors, and that the agreement was not in any way a matter to which the Government were a party. He confirmed the view stated more than once in these columns that the power of the Government is a simple right of veto; he stated quite definitely that the Government would not come to any decision without the fullest possible consultation with the interests concerned, including the chemical industry; he gave an assurance that the House would have a full opportunity of debating the question, but repeated that he was still in ignorance of the terms of the agreement. This was, perhaps, as far as Mr. Webb could be expected to go in his very difficult position, and if it had finished there one might have accepted the case as disappointing but inevitably so. His unfeeling questioners, however, insisted on a searching cross-examination, and it was here that Mr. Webb came out rather badly with a number of ominous reservations. Pressed as to whether he had submitted the terms of the agreement, as he knew them, to such bodies as the development committee or the colours users' committee for their opinions, he declined to state "all the steps that the Government have taken in this matter." Pressed again, he declined to give an assurance that the House would have an opportunity of debating the agreement before the Government decision was taken. "That," he said definitely, "is not possible. The Cabinet will have to come to some decision in its own mind." It is impossible to make out what the real situation is, but it seems clear that the Cabinet will decide itself whether its veto is to be exercised, and it is not at all certain that the House will be consulted before its decision is made. In a situation calling urgently for disclosure and clarification, Mr. Webb has merely succeeded in deepening the mystery.

The Late Sir James Dobbie

THE late Sir James Dobbie, although not a spectacular figure in chemical science, was known as a sound student and teacher, with a long record of honourable work in several fields. Like many of his countrymen he combined with a strong grasp of theoretical principles a shrewd practical sense of their application to practice. One is inclined to recall him in connection with the last appointment he held, that of head of the Government Chemical Laboratories; but perhaps the best work of his life was done while he was Professor of Chemistry at the North Wales University College, Bangor. He went there when the college was young, and he helped appreciably to lay the foundations on which its science side has steadily developed. In particular, he was the main force in developing its Agricultural Department, the first of its kind, we believe, to receive a Government grant-in-aid, and in popularising agricultural science among the rather obstinately conservative farming communities in the northern Welsh counties. It was during this period that we made his acquaintance, and had the pleasure of helping his work in a way that was pleasantly recalled in the recent communication from him. Writing from Fairlie College, Ayrshire, where his death took place, he said: "Although it is now more than thirty years since we started the Agricultural Department of the North Wales University College, I remember well and have never ceased to be grateful to you for the assistance you gave us. Without it I do not think we should ever have succeeded to the extent we did in arousing the agricultural community to an interest in our work."

Although a retiring man, largely immersed in his scientific pursuits, several distinctions fell to him in his later years. In addition to his Knighthood in 1915, he was elected a Fellow of the Royal Society, received the honorary degree of LL.D. from Glasgow University, was elected President of the Institute of Chemistry, and became a vice-President of the Chemical Society.

New Sulphate Price Basis

THE new sulphate of ammonia prices for July and August deliveries, issued by the British Sulphate of Ammonia Federation, indicate an important change in the basis of price fixation. Hitherto the prices have been based on the ammonia content, about 25¼ per cent. in the case of the neutral quality, although for fertilising purposes it is the nitrogen content that really counts. For the future, beginning with the new price list, the nitrogen content is to be taken as the basis, and the list to this extent is issued in new terms. The new price for July and August deliveries is £14 per ton for neutral quality in fine friable condition, free from lumps, basis 21·1 per cent. nitrogen. Limited quantities of

ordinary quality will be available in some districts and will be sold at 23s. per ton less, basis 20·7 per cent. nitrogen. Neutral sulphate, of the quality described, guaranteed not to contain more than ·025 per cent. free acid, will be sold on the basis of 21·1 per cent. nitrogen, with no charge if over 21·1 per cent., but with various concessions according to scale where the nitrogen content falls below this standard. A further allowance of 9s. 6d. per ton will be made where the free acid exceeds ·025 per cent. or where the sulphate is not in fine friable condition. Corresponding concessions as regards the nitrogen content will be made in the case of ordinary sulphate. The change is one to be welcomed as fixing the actual effective value of sulphate as a fertiliser as the basis of price.

Dr. Armstrong's Address

THE presidential address by Dr. E. F. Armstrong at the annual meeting of the Society of Chemical Industry in Liverpool next month promises to be one of unusual interest, especially in its bearing on the chemistry of the great soap industry, with which for some years he has been closely associated. Taking as his subject "A Neglected Chapter in Organic Chemistry—the Fats," he intends, we understand, to deal with the chemistry of the fatty acids and their distribution in nature, based largely on work done in the Crosfield Research Laboratories during the last dozen years, and to put forward certain new hypotheses with regard to the formation of the fatty acids in the plant and the animal. This, in itself, should be a technical contribution of rare interest, but it is not likely to exclude the more public aspects of chemical industry, in which Dr. Armstrong is known to be keenly interested. Though insistent on the plea that chemists should, above all things, really know chemistry, his address at Cambridge last year showed an appreciation of chemistry from many other points of view than that of the laboratory, and one may reasonably expect some further reflections on the relation of chemical industry to commercial and national interest similar to those which attracted such wide publicity last year. These addresses, together with his editing of and introduction to "Chemistry in the Twentieth Century" and his setting in practical motion the idea of a central chemical headquarters, will form, quite apart from his general presidential activities, no unworthy memorial of Dr. Armstrong's two years of office.

Gas Companies and Chemicals

THE Court of Appeal has upheld the decision of Mr. Justice Astbury in the King's Bench Division respecting the right of gas companies to manufacture chemicals for their own use. The issue was raised by Mr. J. L. Deuchar, Secretary of the Castner-Kellner Co., who sought to restrain the Gas Light and Coke Co. from manufacturing caustic soda for the treatment of their own residuals, the latter company having previously purchased this substance from chemical manufacturers. In both courts judgment was given in favour of the gas company on the principle which, we believe, has hitherto governed such cases, namely, that though gas companies cannot manufacture chemicals for sale as chemical manufacturers they are entitled to manufacture such chemicals as are required for enabling them to carry on the business described in their empowering acts. In other words, they must not trade as chemical manufacturers with outside parties, but they may manufacture such chemicals as they need for use in their own legitimate business.

Points from Our News Pages

Articles are published on "The Electrolytic Caustic Soda and Solvay Ammonia-Soda Processes," by P. Parrish (p. 666), and "Progress in By-Product Sulphate of Ammonia Manufacture," by P. Heigham (p. 669).

The death is announced of Sir James Dobbie, formerly chief of the Government Chemical Laboratories (p. 670).

In reply to several speeches in the House of Commons on the Anglo-German dye agreement Mr. Sidney Webb made a statement as to the Government position, and was vigorously cross-examined (p. 671).

Papers dealing with liquid oxygen and its use in liquid-oxygen explosives were presented at the International Refrigeration Congress (p. 673).

Notes on recent developments in French chemical industry are published from our Paris correspondent (p. 674).

The Court of Appeal has upheld the decision of Mr. Justice Astbury authorising the Gas Light and Coke Co. to manufacture caustic soda for their own use (p. 674).

The British Sulphate of Ammonia Federation announces that for the future the price basis of sulphate will be the nitrogen content instead of the ammonia content. The standard for the best neutral is 21·1 per cent. nitrogen and for ordinary quality 20·07 (p. 665).

Mr. J. Boodson, general secretary of the B.A.C., suggests steps for informing unsuccessful applicants for chemical appointments when the vacancies have been filled (p. 668).

Judgment is expected shortly in the ammonium perchlorate claims before the Royal Commission on Awards to Inventors (p. 682).

A slight improvement, with more inquiry and better prospects, is recorded in the London Chemical Market. Our Scottish report describes the past week as the quietest in heavy chemicals for some time (p. 683).

Books Received

JAMES DEWAR. By H. E. Armstrong. London: Ernest Benn, Ltd. Pp. 32. 1s. 6d.

THE STRUCTURE OF MATTER. By J. A. Cranston. London: Blackie and Son, Ltd. Pp. 196. 12s. 6d.

ELECTRODE REACTION AND EQUILIBRIA. A General Discussion held by the Faraday Society. Pp. 172. 10s. 6d.

PULVERISED FUEL AND EFFICIENT STEAM GENERATION. By David Brownlie. London: The Institution of Electrical Engineers. Pp. 470.

FIRST (EXPERIMENTAL) REPORT TO THE ATMOSPHERIC CORROSION RESEARCH COMMITTEE (OF THE BRITISH NON-FERROUS METALS RESEARCH ASSOCIATION). By W. H. J. Vernon. London: The Faraday Society. Pp. 96. 7s. 6d.

The Calendar

June 30 to July 12	World Power Conference	Wembley, London.
9	Society of Chemical Industry: Annual General Meeting. Presidential Address by Dr. E. Frankland Armstrong. 11 a.m.	Arts Theatre, The University, Liverpool.
10	Society of Chemical Industry: Messel Memorial. Lecture by the Rt. Hon. Viscount Leverhulme.	
	Society of Chemical Industry: Annual Dinner	Midland Adelphi Hotel, Liverpool.
15	Institute of Chemistry Students' Association (London). Visit of Students to Wembley.	London.
19	Physical Society of London: Special meeting by the kind invitation of Sir Ernest Rutherford, and of the Directors of the Cambridge-Paul Scientific Instrument Co.	Cambridge

The Electrolytic Caustic Soda and Solvay Processes

By P. Parrish, A.I.C., M.I.Chem.E.

In the following article the author reviews the efficiency of the electrolytic and the Solvay processes for the production of soda in view of the suggested supersession of the last named by the more recently developed method

SINCE the opinion was expressed in the 1923 review relative to developments in the heavy chemical industry, that "*In much the same way as the Solvay ammonia-soda process threatened the extinction of the Leblanc process fifty years ago, so does the electrolytic caustic soda process constitute a menace to the life of the ammonia-soda process to-day*," evidence has been forthcoming of increasing interest in the processes for the production of electrolytic caustic soda.

It is desirable to examine what is involved in the electrolysis of a solution of common salt prior to considering how far the statement in question is likely to prove an accurate prediction.

Electrolytic Cells

Numerous types of cells have been put on the market and much inventive ingenuity has been displayed in perfecting these. Despite this, few have achieved commercial success.

An electrolytic cell, in its simplest form, is a chamber composed of materials capable of resisting chlorine. Such chamber has provision for containing a saturated brine, in which a positive and negative electrode are immersed. By the passage of an electric current through the electrodes and the brine electrolyte, gaseous chlorine is liberated at the anode, and simultaneously, metallic sodium is released at the cathode. As one will appreciate from its chemical properties, metallic sodium immediately combines with water in the brine to form caustic soda, and liberates gaseous hydrogen.

Thus the products of electrolysis of a saturated brine are a weak solution of caustic soda, hydrogen, and chlorine.

The chlorine, however, has an affinity for caustic soda, forming sodium hypochlorite. Cells to produce the latter product are sold for laundry use, and various municipal bodies have installed them in this country as a means of preparing a suitable disinfectant, or a deodorant.

A perfect cell, from the point of view of caustic soda production, should provide against the combination of chlorine and the solution of sodium hydrate. Development has proceeded apace with the latter object in view, and it is known that four distinct lines of evolution have been pursued. These may be briefly summarised as follows :—

(*a*) The introduction of a permeable diaphragm between the anode and cathode.

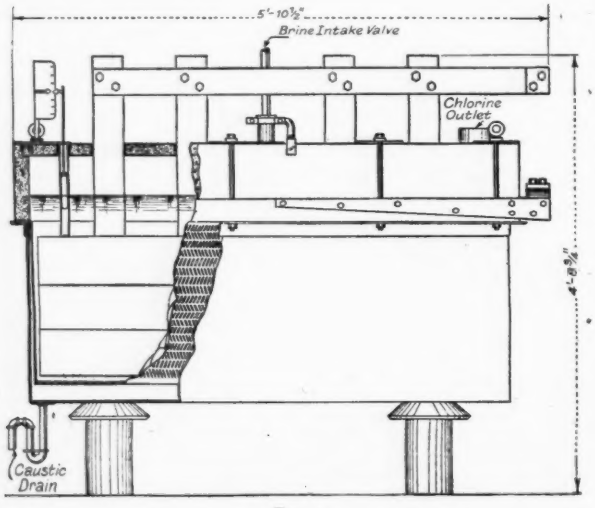


FIG. 1.

(*b*) The adoption of a mercury cathode, which serves a dual purpose, viz., as the cathode in the electrolysing compartment of the cell and the anode in the abutting compartment, where the amalgam (sodium-mercury) is decomposed by water.

(*c*) By superposing the anode on the cathode and relying on stratification of the electrolyte, which occurs owing to the different densities of the brine and the weak caustic soda solution surrounding the immersed cathode, and

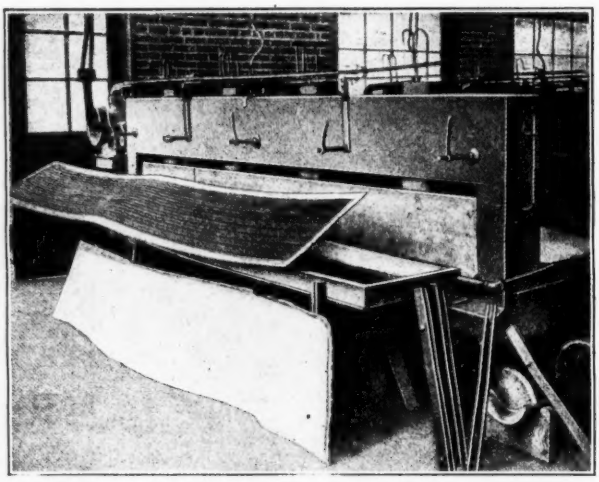


FIG. 2.

(*d*) By the use of a fused salt electrolyte and a molten lead cathode.

As far as is known to the writer, only the mercury and diaphragm types have survived. The mercury cell, as used by the Castner-Kellner Co., involves heavy capital expenditure. Hence, diaphragm cells are those to which almost exclusive consideration is given. These can be classified as (*a*) cells with submerged diaphragms and cathodes, and (*b*) cells in which the electrolyte is brought in contact with one face of an unsubmerged diaphragm.

The Gibbs's cell, which is used by one of the largest alkali companies in this country, comes under the first category. The second category, which has reference to unsubmerged diaphragms, is again sub-divided into permeable and impermeable diaphragms. The Allen-Moore cell belongs to the first sub-division. The second sub-division is exemplified by the Hargreaves-Bird cell, known to be employed by one of the electrolytic companies in the Cheshire district. The latter cell produces sodium carbonate, which must be causticised if caustic soda is to be produced. Thus an additional, and not inexpensive, operation is involved if caustic soda is the required product.

Asbestos paper or cloth placed in the cell, so as to separate it into two distinct chambers (the anode one, in which saturated brine is introduced and chlorine is formed, and the cathode one, where caustic soda is produced), constitute the permeable diaphragms for both the submerged and unsubmerged types of cells.

Cells of the submerged diaphragm type are known to work with a reasonably high efficiency for a few weeks with a new diaphragm. With age, the permeability of the diaphragm is destroyed, and ozmotic influences begin to operate. Hypochlorite is formed, with consequent reduced life of the anodes and a low current efficiency.

With cells of the (*b*) type, having the permeable diaphragm immersed on one side only, contamination of the character indicated above is practically eliminated.

Figs. 1, 2 and 3 illustrate the construction and characteristics of the Allen-Moore cell, which has been installed extensively for the production of electrolytic caustic soda. Fig. 2 especially illustrates the drop side feature of the cell, as alike the anode construction. From the point of view of simplicity of design

it would be difficult to improve on the drop side feature of this cell. Changing diaphragms or repairing anodes only occupies a few minutes. The construction of the anode allows of a thorough circulation of the electrolyte. The importance of this factor cannot be over-emphasised, as in the absence of complete circulation it is impossible to secure efficient results. Defective circulation represents loss of product and increasing wastage of the anode.

Fig. 3 shows a unit of 64 Allen-Moore cells, the space between which, as is seen, allows the attendant to work unhampered at any part of the cell room.

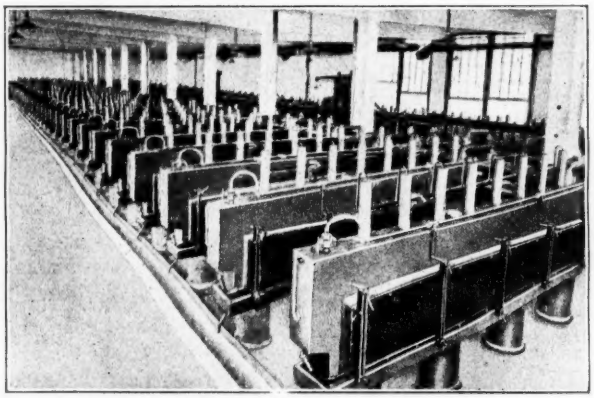


FIG. 3.

Comparative Cell Information

In order that a contrast can be made of the various well-known cells, the following table of comparative cell information is furnished :—

	Townsend	Nelson	Allen-Moore
Floor space per 1,000 amps	9·72 sq. ft.	12·6 sq. ft.	22·22 sq. ft.
Current density per square foot of diaphragm	100 amps.	57 amps.	48 amps.
Amperes per cell ..	4,000	1,000	1,000/1,500
Voltage per cell ..	4·5 volts	4·0 volts	4·0 volts
Overall efficiency ..	95 %	82/85 %	90 %
Energy efficiency . ..	48·55 %	48·01 %	51·75 %
Strength of Cl. ..	60·65 %	90·00 %	90·00 %
Caustic solution ..	13·00 %	9·00 %	11·00 %
Cost per cell complete	*	$300	$450

The yield on electrolysis from one ton of pure salt, based on a 92 per cent. efficiency, is as follows :—

$$\underset{58\cdot5}{NaCl} + \underset{18}{H_2O} \text{ on electrolysis yields } \underset{40}{NaOH} + \underset{1}{\tfrac{1}{2}H_2} + \underset{35\cdot5}{\tfrac{1}{2}Cl_2}$$

1,408 lb. caustic soda,
=1,250 lb. chlorine, and
35·2 lb. of hydrogen.

Ammonia-Soda Process

It will now be expedient to consider the ammonia-soda process in some detail, as only by visualising correctly what is involved can an accurate contrast be made.

The production of ammonia-soda involves the passage of carbon dioxide through brine saturated with ammonia, when the following reactions occur in a consecutive manner :—

(1) $2NH_3 + H_2O + CO_2 = (NH_4)_2CO_3$.
(2) $(NH_4)_2CO_3 + H_2O + CO_2 = 2NH_4HCO_3$.
(3) $NaCl + NH_4HCO_3 = NaHCO_3 + NH_4Cl$.

The brine is pumped direct to the ammonia saturators, and does not usually undergo any preliminary purification. The saturators take the form of a tower, in connection with which special serrated distributing devices are used for the ammonia. These devices are sealed to a pre-determined depth in brine solution, which overflows from tray to tray. Concentrated ammonia liquor containing about 0·5 per cent. of H_2S, on the basis of 25 per cent. NH_3, is used to restore the ammonia lost in the process. The temperature of the brine solution must be maintained below 60° C. by suitable means. The gas emerging from the saturators is passed through a second tower, or washer, to arrest the ammonia. The final tower is coupled to a vacuum pump, so as to reduce the pressure against which the ammonia issuing from the stills has to work.

Due to the presence of sodium and ammonium bicarbonate in the mother liquor from the carbonating tower, it will be found that carbon dioxide is always associated with the gaseous ammonia from the stills. The liquor leaving the ammonia saturators usually has a composition of the following order :—

	NaCl	NH_3	CO_2
Grammes per litre	260	80	45

To remove the suspended carbonates of calcium and magnesium arising from the impurities in the brine, the liquid leaving the saturators is passed to decantation tanks. A clear supernatent liquor of tolerably constant composition is produced, and this is cooled to 30° C. to prevent loss of ammonia, and is then fed to the carbonating apparatus. Meanwhile, the mud recovered in the decantation tanks is treated for the recovery of ammonia.

Carbon dioxide is pumped through the clear supernatent liquor, which is distributed over a Solvay tower, in the lower portion of which Cogswell coolers—a multitubular form of cooler, consisting of a number of mild steel pipes placed horizontally, and through which water flows—are expanded into tube plates.

Carbonation usually proceeds in two stages, giving rise to the production of (1) ammonium carbonate, and (2) to the formation of ammonia bicarbonate, and the deposition of sodium bicarbonate. It is the practice to carry out each stage in a separate tower, and in the second apparatus a definite temperature of about 30° C. is maintained, so as to produce bicarbonate of the proper consistency.

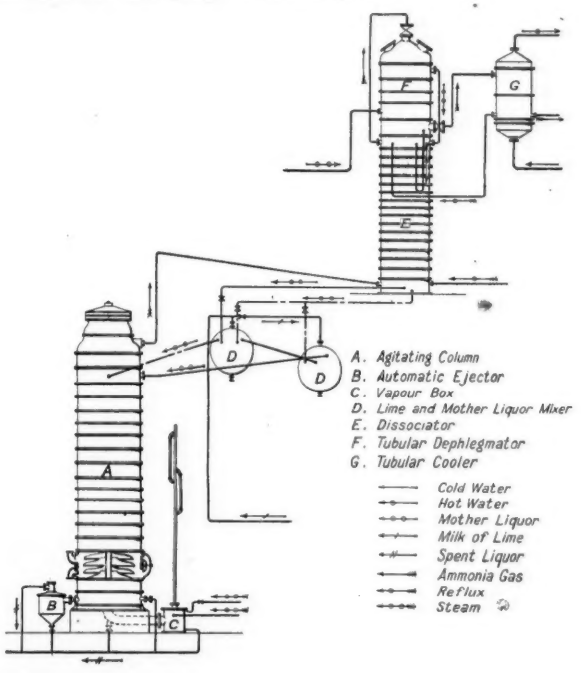


FIG. 4—MALLET STILL.

Owing to the formation of hard crusts of bicarbonate in the second tower, which create blockages, it is necessary to reverse the order of working the towers, and in this way the crusts are dissolved.

The carbon dioxide used in the process of carbonation is

* Owing to the need of vaults in connection with brine circulation the cost of the Townsend cell, on a small scale, is prohibitive, and not indicative of the true merit of the cell. The installation of 60 Townsend cells, including the cost of vaults and cell room building may be safely based on $1,200 per cell.

obtained from two sources, either (*a*) lime kilns, or (*b*) calcination of bicarbonate in the production of soda ash.

The CO_2 content of lime kiln gas varies, of course, with the working, but reaches as high as 40 per cent. The calciner gas varies in CO_2 content from 90 to 98 per cent. In practice, a mixture of the two is favoured for the carbonation of the ammoniacal brine. In this way an average of about 53 per cent. CO_2 is secured. The mother liquor emerging from the carbonating process along with the magma of bicarbonate undergoes filtration in a specially designed rotary filter, embracing a perforated drum covered with special filter cloth. A portion of the filter cloth dips into the dish containing the semi-solid, and a suction is applied from inside. Thus a layer of sodium bicarbonate collects on the filter cloth. This is washed with water to remove traces of ammonia, and is subsequently dislodged by knives as the cylinder rotates.

During the washing of the cake, the mother liquor is diluted, and contamination with sodium bicarbonate occurs. The mother liquor contains practically all the ammonia originally present in the ammoniacal brine. The mother liquor has the following approximate analysis :—

1·8 per cent. of volatile ammonia and
6·0 „ „ of fixed ammonia, largely as NH_4Cl ;

= 7·8 „ „ total NH_3.

The principle followed in the treatment of the ammoniacal mother liquor is much the same as that pursued in the distillation of gas liquor. The stages of the distillation, or dissociation, are broadly divided into three. Initially, the volatile ammonia is dissociated, after which the liquor containing the fixed ammonia is mixed with cream of lime in a special rotary mixer, and, subsequently, the limed liquor is distilled. At all events, this is the procedure with the latest type of apparatus, which is illustrated in Fig. 4.

Instead of a steam and ammonia ratio of 85–80 : 10–15, which obtains in the manufacture of sulphate of ammonia, a fairly pure and dry mixture of carbon dioxide and ammonia is evolved in the distillation of the ammonium chloride liquors. The latter gases are led to saturators for the preparation of ammoniated brine.

The raw materials used in the manufacture of one ton of soda ash, and their estimated cost, are given below :—

	£	s.	d.
Coke : 1·3 cwt. at 1s. 3d. per cwt.	0	1	7½
Limestone : 24 cwt. at 20s. per ton	1	4	0
Coal : 10 cwt. at 27s. 6d. per ton	0	13	9
Ammonia : 5 lb. at 6d. per lb.	0	2	6
	£2	1	10½

The above compares with the selling price to-day, of, say, £5 per ton, naked at the alkali works.

The Solvay ammonia-soda process as conducted to-day is a notoriously efficient one in every detail. One evidence of this, typical of many others, is to be found in the percentage loss of ammonia per ton of soda ash made. This loss has reached the phenomenally low figure of 0·7 per cent.

Factors Affecting the Menace

Space is not available for anything approaching a full discussion of the several factors involved in the suggested menace. There is, however, ground for the belief that caustic soda can be produced more cheaply by the electrolytic process than by any other, provided that a suitable outlet is afforded for the secondary products resulting from the utilisation of the hydrogen and chlorine. Again, there appears to be no reason —technical or economical—why sodium carbonate (soda ash) should not be produced by direct electrolytic methods, or by the carbonation of electrolytic caustic soda. In this case, of course, the method of evaporation should be a peculiarly efficient one.

Above all, however, it can be said that the development of the electrolytic caustic soda process, as indeed, the nature of the menace to the Solvay ammonia-soda process, depends essentially on the ability to develop additional uses and markets for the secondary products involving the use of chlorine.

Progress in this direction depends upon research, as, indeed, upon trade improvement and development.

Vacancies for Chemists

To the Editor of THE CHEMICAL AGE.

SIR,—The attention of my Council has been drawn to the position of chemists replying to advertisements under "Situations Vacant," who are invariably kept in suspense for a considerable period owing to the fact that advertisers generally do not reply to unsuccessful applicants.

It is realised that the sending of a reply to each applicant is in most cases ruled out owing to the labour and expense involved, but there are three methods by which applicants might be advised at but slight cost, and these my Council recommends to the earnest consideration of advertisers in the technical press, as follows :—

(1) When a situation is filled, a small advertisement to that effect should be inserted in the journal or journals in which the original advertisement appeared.

(2) All journals inserting advertisements under "Situations Vacant" should keep a small space below for "Situations Filled," and advertisers should be asked to inform the editor when the situations are filled. The insertion of the "Box Number" under the heading "Situations Filled" would be all that was necessary.

(3) Advertisers might make use of the B.A.C. Appointments Bureau. All advertisements appearing in the technical press are circulated weekly to members of the Association on the Register. If, when a situation is filled, the advertiser would inform me of the fact that "Box No. —, THE CHEMICAL AGE," was filled, this fact would be circulated with the next issue of the list and some, if not all, of the applicants would learn of it.

The applicant for a situation is worthy of some slight consideration, and my Council feels that the adoption of one or other of the above suggestions would be greatly appreciated by all chemists. I might add that we are writing to all advertisers asking to be informed when the situation is filled, so that we may pass on the information to our members, thus, in effect, adopting the third suggestion. We realise that the first or second would reach a larger public, and as we have at heart the welfare, not merely of our members, but of the profession as a whole, we would urge the adoption of one or more of these suggestions.—Yours, etc.,

J. BOODSON,
General Secretary.

British Association of Chemists.
June 19.

Sillimanite Deposits in India

ONLY small scattered deposits of sillimanite are known in the United States, no commercial sized deposits being located to date, according to Mr. W. M. Myers, assistant technologist, in Serial 2587 of the U.S.A. Bureau of Mines. A large deposit is reported to occur in India. Very superior refractories are said to be made almost exclusively of synthetic sillimanite. Whether natural cyanite or sillimanite can be substituted can only be determined by careful research. As the value of the andalusite group of minerals becomes better known and as more people become acquainted with their appearance so that they can recognise them in the field, it is possible that other deposits may be found possessing sufficient tonnage and favourably located with regard to transportation to make their development possible.

Wembley Exhibition Attractions

THE British Empire Exhibition continues to draw large attendances and additions are still being made to its attractions. Our weekly notes are crowded out this week, but will be continued in the next issue. Next week the World Power Conference, arranged by the British Electrical and Allied Manufacturers' Association, opens on Monday, and will continue for a fortnight. It is expected that there will be many features of interest for chemical engineers in connection with power production dealt with in the papers to be presented.

German Dye Plant Closing

A BIEBRICH report states that Kalle and Company, Biebrich, one of the members of the German dyestuff trust, the I.G., have closed several departments which have been working at a loss for some time, and have also curtailed production very much in most other branches.

By-product Sulphate of Ammonia Manufacture

By P. Heigham

The author reviews succinctly the progress made in the manufacture of by-product sulphate of ammonia in the last ten years, particularly in the production of the neutral quality, and deals with methods of neutralisation, drying, and crushing.

In the Chief Alkali Inspector's report for 1914 the following statement is made:—"The standard quality of British sulphate of ammonia has been the subject of discussion in the circles interested, some of the sulphate produced in this country prior to the war being said by foreign consumers to compare unfavourably to a marked degree with the product received from Germany." This appears to be the first indication that British sulphate of ammonia manufacturers were awakening to the necessity of improving the quality of their product. A review of the progress made since Mr. Curphey's report would seem to be of interest in view of the statement by the British Sulphate of Ammonia Federation that over 74 per cent. of the present ammonium sulphate production is in the form of dry neutral salt.

The Movement for Neutral Sulphate

In spite of the attention directed to this matter in 1914, it was not until 1917 that serious attempts were made to manufacture a superior product. Patent literature of the period affords a good indication of the amount of work that producers have devoted to the subject. One of the earliest modern British patents in this connection seems to be that taken out by Heinrich Koppers in 1913, which specifically mentions the production of neutral sulphate; nothing further appeared in this connection until late in 1916.

Subsequent to the latter date a number of patents bearing directly on the production of neutral dry sulphate have appeared; the number is still being multiplied.

One of the earliest of these patents is that granted to the Riter Conley Manufacturing Co. of New Jersey in 1917—No. 104,155—using a system of electrically-controlled thermostats, hydrometers, and valves, whereby a constant volume and acidity in the saturator are maintained by an electrical control, the salt being water washed during its elevation from the saturator. This method does not appear to have been adopted in England.

This patent was followed by No. 108,098 of 1917, by W. G. Adam of the Gas Light and Coke Co., who specifies the use of gaseous ammonia as the neutralising agent acting on the ammonium sulphate in some suitable drying plant after the latter has been passed through the centrifugal hydro-extractor. This process, with various modifications, has been adopted by many makers, and several types of apparatus to utilise this method have been designed and patented, all depending primarily on the key patent.

To these there succeeded No. 108,990 of 1917 by Felix Caproq, who washes the crystals in the centrifugal basket with neutral mother liquor. This washing process has been utilised at several works, ordinarily by using either mother liquor rendered alkaline with ammonia, or with dilute aqueous ammonia. The latter is readily obtained either by condensing a small amount of the gases from the fixed portion of the ammonia still, or, as was suggested later by the South Metropolitan Gas Co., by utilising the condensate from the gases given off in an expansion box placed in the pipe carrying off the effluent liquor.

Altogether, there are only four patents in 1917 directly referring to neutral sulphate, namely, those to which reference has already been made, and a last by E. V. Evans, who adopts a saturator worked to the neutral or alkaline state, followed by filtration and subsequent cooling.

Other patents of more recent dates use various solid reagents, all of which are more or less applicable. The neutralisers suggested include sodium carbonate, lime, chalk, ammonium bi-sulphite, sulphite, carbonate, etc. These are either sprayed as a solution into the salt in the centrifugal basket or are mixed as dry powders with the whizzed salt in the drying portion of the apparatus.

The Double Saturator Method

The double saturator method of treatment, to which several patents are devoted by different inventors, depends on maintaining the second saturator in a neutral condition, while the first saturator is kept at normal acidity, the ammonia gases passing from the second saturator to the first in a direction opposite to the flow of the mother liquor; this process lends itself to several modifications. The second saturator may either be continuously or intermittently worked, or a further modification may be adopted according to a patent owned by the South Metropolitan Gas Co. by passing the gases obtained from the fixed ammonium salts through the second saturator, while the free ammonia is conducted through the primary saturator. This refinement is suggested in order to preserve the finished product a good white colour; it avoids the formation of ferro-cyanide and contamination with tar.

Further patents are chiefly simple modifications of the foregoing, coupled with a variety of obvious methods of drying and crushing.

The double saturator type of apparatus appears to be convenient and adaptable for small works practice where the extra space required is not actually large, and where the extra capital involved is proportionately small. This type of plant on a small scale, working with a draining table, obviates that wear and tear on copper or phosphor bronze centrifugal baskets which is entailed by the use of alkaline solutions. Several of these plants have been successfully installed.

A method for medium and small plants that seems much in vogue is that of using ammoniacal mother liquor or ammoniacal liquor alone as a wash for the whizzed salt in the centrifugal basket; this necessitates the primary spinning of the salt, a slowing down of the centrifugal during the application of the ammoniacal liquor, and a further spinning for the production of the usual whizzed salt containing $1\frac{1}{2}$–$2\frac{1}{2}$ per cent. of moisture. The strong odour of ammonia and pyridine consequent on this proceeding constitutes a grave nuisance to the workmen unless adequate ventilating fans are used. The free ammonia involved rapidly attacks copper and bronze; consequently the wear and tear on the centrifugal baskets must receive constant supervision to avoid burst baskets and risk of serious accidents. Care, too, is needed to avoid flooding the saturator by these repeated additions of ammonia liquor.

Having regard to the ordinary standard methods at present in use for the production of sulphate of ammonia in this country, the gaseous ammonia method of neutralising appears to be the one most suitable, at least to medium and large-sized works, seeing that it entails but little extra plant. The neutralisation by means of gaseous ammonia can readily be effected in the same apparatus as is used for the final drying. There is no extra wear and tear on the centrifuge, nor prolongation of time necessary for whizzing, nor discomfort to the workmen by reason of pyridine and ammonia vapours. Any ammonia which passes through the dryer can be drawn through a tower, down which acid is run, the acid then being used in the saturators.

On a large works the whole of the drying and neutralising can adequately be supervised by one man, who would in any case be necessary for the drying plant alone.

Drying and Crushing

So far only the neutralisation of the sulphate has been touched upon, but it is necessary to dry and also to crush any lumps that may be formed. This part of the process has been responsible for a great variety of apparatus.

Most of the earlier patents were content to mention only the neutralisation of the sulphate as their subject matter, although the aim of all manufacturers has been the dry neutral product. It was considered that the problem of drying had been handled more or less successfully in other industries, and consequently some easy adaptation of an already existing method would quite possibly meet the case for sulphate. This is very largely true, and one of the simplest means of drying sulphate is to use an ordinary rotary dryer heated directly by the products of combustion from a small coke furnace, suitable means being provided to allow a certain amount of air to be drawn through to maintain the dryer at a suitable temperature. This form of apparatus also lends itself readily to the use of gaseous ammonia, which thus needs

only to be fed into the dryer with the furnace gases; the outlet from the dryer can be arranged to discharge the dry neutral salt into some screening device from which the lumps then proceed to a crusher. The latter, together with the screen, discharge into the boot of an elevator which deposits the salt in a hopper or other suitable storage.

Other Types of Driers

Another dryer in common use takes the form of horizontal trays arranged in tiers, the heating being effected by either a direct counter-current of hot furnace gases, or alternatively steam heating by means of a false floor. The salt is dropped from tray to tray by the action of arms fixed in a central vertical shaft. One successful modification of this principle consists of a single rotating plate under which gas burners are fixed, stationary arms acting as rakes being set at various angles in order to stir up the salt during drying and so to prevent caking. When the sulphate is dry it is discharged by the exceedingly simple method of holding a shovel on the tray.

A third type of dryer is of the fixed horizontal cylindrical nature, and is steam heated. The salt is agitated by paddles on a horizontally rotating shaft, likewise steam heated, and is neutralised before being put into the dryer.

One manufacturer, operating on a large scale, drops the already centrifugated and neutralised sulphate down a tower, suitably fitted with baffles, up which hot air is drawn, the salt being then re-elevated to the top of the tower, and the process repeated until the salt is dry.

It is obvious that any suitable drying apparatus with convenient discharge can be utilised for such a purpose as that under discussion. The conditions to avoid are those which tend to promote caking of the sulphate, likewise those which might cause loss of ammonia by overheating of the salt, and any excessive flow of gases through the apparatus. Excessive draught tends to carry away the finely divided salt from the dryer, and so to choke the fans or final catch towers (where the latter are used).

Importance of the Nitrogen Content

It is interesting to note that owing to shipping difficulties during the war the home farmer was to a certain extent converted to the use of sulphate of ammonia as a fertiliser. In the last analysis, the farmer's problem is simple, namely, the financial value of available nitrogen in the fertiliser, due regard being paid to such conveniences as economy of handling, absence of corrosive action on bags and bins, ease of manipulation and distribution on the land, etc. What a farmer has to consider is not the price of fertiliser per pound, but the weight of economically assimilable nitrogen per £. s. d. That this phase of our national economy appeals to the agriculturist is shown by the following figures obtained from the British Sulphate of Ammonia Federation. In 1913 some 40,000 tons alone of sulphate were sold at home out of a total production of 370,000 tons, whereas during the year ending April, 1924, out of a total output of 360,000 tons, the amount required for home consumption was 130,000 tons.

In conclusion, the Chief Inspector of Alkali Works may again be quoted. In his report for 1920 he states: "The production of a dry neutral sulphate of ammonia is receiving increased attention, and the arrangements for the installation of plant with this end in view are being made at a number of works." At this period only 6½ per cent. of the total output of sulphate was then being produced in the dry neutral form. In the 1921 report the following paragraph appears: "The advantages of a dry neutral sulphate for agricultural purposes are becoming more and more recognised, and during the year much activity has been displayed in the perfecting of methods for its production."

All Neutral Production in Future

There is little doubt that such activities are still being displayed and that before long practically all the sulphate produced in this country will be of the dry neutral variety. In the long run, it never is to the advantage of a manufacturer to work in opposition to what he knows to be true. Experimental results have amply demonstrated the superiority of dry neutral sulphate over the old acid variety, and it is in conformity with these results and with the appreciation of this by the farmer that the present activities of the British Sulphate of Ammonia Federation are directed.

Death of Sir James J. Dobbie

Retired Chief of Government Chemical Laboratories

THE death is announced at his residence, The Cottage, Fairlie, Ayrshire, of Sir James Johnston Dobbie, LL.D., F.R.S., who until a few years ago was Principal of the Government Chemical Laboratories, London, and later served on the Royal Commission on Awards to Inventors.

Sir James Dobbie was born in Glasgow in 1852, and was educated at the High School and Glasgow University, where he graduated in Arts with first class honours in natural science and obtained the George A. Clark Scholarship. He studied later at Leipzig and Edinburgh, taking his D.Sc. at the latter University. After a period as Lecturer in Mineralogy at Glasgow University he was appointed in 1881 assistant to the Professor of Chemistry, which he held until his presentation to the Chair of Chemistry in the University College of North Wales at Bangor. His services as a scientific chemist while in Wales were not confined to the problems of pure science dealt with in his published papers. Much of his attention was devoted to the introduction of new methods of agricultural education, and his services in this direction were cordially acknowledged by the Board of Agriculture. In 1903 he accepted the post of director to the Royal Scottish Museum, Edinburgh, which he held for six years, relinquishing it on his appointment as Principal of the Government Laboratories, where he did valuable work throughout the war and until his retirement in 1920. Since then he had given much time to the affairs of the Royal Commission on Awards to Inventors, of which he was a member. He was also on the University Grants Committee. In 1915 his services to science, both as investigator and administrator, were recognised by the King, who conferred a knighthood on him. In 1904 he was elected a Fellow of the Royal Society in recognition of the value of his numerous publications on the chemical constitution of alkaloids and the relation between the chemical constitution and the absorption spectra of chemical compounds. Four years later Glasgow University conferred on him the honorary degree of LL.D. He was a past president of the Institute of Chemistry, and vice-president of the Chemical Society. Sir James Dobbie is survived by his wife and one son and two daughters. One of his daughters is the wife of Professor Haworth, Armstrong College, Newcastle-on-Tyne.

Gas Engineers' Annual Meeting

THE annual meeting of the Institution of Gas Engineers opened on Tuesday at the Institution of Electrical Engineers, and continued the two following days. In the course of his address, the president, Mr. Samuel Tagg, said that the gas industry had rendered valuable service to the nation by developing the use of gas and coke in place of coal, and so reducing the evils arising from smoke. Those evils would eventually be entirely eliminated if the industry could accompany the extended application of gas with the supply of a solid, smokeless fuel which would compete in price with coal and prove as attractive in use. Much work had been done in this direction, but much remained to be done. Such a fuel was needed, for while it would tend to a conservation and proper use of the coal supplies of the country it would at the same time reduce the prevalent smoke evil and confer a further benefit by improving domestic amenity and industrial efficiency. A luncheon was held at the Savoy Hotel, when the speakers included Professor Arthur Smithells and Dr. Charles Carpenter (past-president of the Society of Chemical Industry).

"Shell" Chemical Extensions

AT the annual general meeting of the "Shell" Transport and Trading Co., Ltd., held this week, considerable reference was made to the chemical side of the firm's activities. Refineries have been greatly extended, especially in Curaçao, where extensions are still in progress owing to the ever-increasing Venezuelan production. Great progress has been made in dealing with the various chemical problems which continually arise. The Chairman mentioned that the firm were producers, refiners, transporters, and distributors of oil, and makers of candles, road materials, lubricants, medicinal oils, and numerous other by-products.

The Government and the Dyestuffs Agreement

Mr. Webb's Replies to Inquiries

In Committee of the House of Commons on Thursday, June 19, several members raised the question of the Anglo-German dyestuff agreement and pressed for a definite statement of Government policy. We give below the President of the Board of Trade's reply as reported in "Hansard" for June 19.

MR. SIDNEY WEBB: I am in the difficulty that I cannot give the Committee satisfaction or knowledge with regard to the proposed agreement between the British Dyestuffs Corporation and the German combination. It is an old story. This Government is not responsible for the British Dyestuffs Corporation, or for the adjustment of capital, or even for the appointment of the Government directors, or for the negotiations about this agreement. It began before we came into office, but there must be continuity in these things, and we are dealing with it. I want, as far as I can, to disabuse the minds of the Committee of suspicion in this matter. I can say quite definitely that the Government will not come to any decision on this important matter of the agreement of the British Dyestuffs Corporation, or in dealing with the British Dyestuffs Corporation in any way, without the fullest possible consultation with the representatives concerned—the representatives of the colour users, of the textile industry, and even the representatives of the chemical industry, because we quite realise how much they also are concerned.

Mr. BLACK: What about the merchants?

Mr. WEBB: We shall consult with everyone concerned in the trade, and, after all, we shall have to deal with representatives. As to the agreement I cannot say anything, because no agreement has been completed; but, if an agreement is completed, it will be completed, not with the Government, but with the British Dyestuffs Corporation and the Interessen Gemeinschaft in Germany. That agreement has not been made, and, consequently, I cannot give the terms of it. I have not seen it. Of course, I have been consulted about it with regard to this or that proposed subject of agreement, but the subject-matter changes constantly, and it is not possible, until some definite action has been taken, to communicate anything to the Committee.

Mr. B. SMITH: If the effect of the agreement between the German and British companies is in fact to raise the price of the commodity, has not the President of the Board of Trade some means of checking that?

Mr. WEBB: The only power the Government has in the matter is that it has the right to veto any act of the Corporation which violates the fundamental purpose for which the Corporation was brought into being, and, therefore we have to look very carefully at all the points which have been mentioned. One hon. member drew attention to the importance of building up a real manufacture of effective dyestuffs in this country, and that is one of the fundamental objects.

Mr. WADDINGTON: Will the right hon. gentleman definitely state to the Committee whether the agreement cannot be completed until the Government have given a decision on the heads of the agreement which are in front of them?

Mr. WEBB: The position is that the Government have no power to prevent the Corporation making an agreement with anybody. In fact, if the Government veto any such agreement, the agreement would not be made. The hon. member asks me categorically whether we can prevent the agreement being made. No, but we can veto it as soon as it is made.

Mr. WADDINGTON: I am sorry to interrupt again, but it is rather an important point. Has the President of the Board of Trade given the heads of this agreement to any Committee in this country, the Development Committee or the Colour Users' Committee, for them to consider and report to him as to whether they approve of all the heads of the agreement, and will it be handed over to the British Dyestuffs Corporation to complete the agreement?

Mr. WEBB: I am sorry the hon. member presses me on that point. It is a new point. That is not what he said before. I was endeavouring to satisfy him on the point he was raising before. He now asks what steps the Board of Trade have been taking on this point. I am not prepared to state all the steps that the Government have taken in this matter. What I can explain to the Committee is that the Government are taking every precaution to see that nothing shall be done which is inconsistent with the fundamental purpose for which the Corporation was established, that purpose being to have a dyestuffs industry in this country that would be able to make dyes as well as anybody else, and, incidentally, that we should provide for chemical research. We hold research to be one of the fundamental purposes.

Mr. BLACK: The President has not informed the Committee whether he put a veto on the agreement, and if the House will have an opportunity of seeing the terms and discussing it.

Mr. WEBB: The hon. member will realise, if he will endeavour to follow what I am saying, that the agreement has first to be made. It is then open to the Government to veto it. After the agreement is made it will be published and the House will have an opportunity of seeing it before the Government have precluded themselves from vetoing it. The Government can always veto it afterwards.

Mr. H. H. SPENCER: Will the Government undertake that, before they make their decision whether they will veto the agreement or not, this House will have an opportunity of debating the question will full knowledge of what the agreement is?

Mr. WEBB: I will certainly give an assurance that the House will have a full opportunity of debating it.

Mr. SPENCER: Before the Government take their decision?

Mr. WEBB: Pardon me, that is not possible. The Cabinet will have to come to some decision in its own mind, but before it is precluded from taking action the House will have an opportunity.

Mr. SPENCER: Let me be quite clear. Before the Government either confirm or veto the agreement, will this House have the opportunity of debating the subject, with the full knowledge of what the terms of the agreement are before the Government act?

Mr. WEBB: I am not prepared to quibble with the hon. member. It must be a matter for the responsible Government of the day. I have pointed out that the Government can do it at any time, and consequently the House will have an opportunity. If the agreement is made, the House will have the terms and will be able to call on the Government to veto the agreement.

Mr. SPENCER: That is the point, before they act?

Mr. WEBB: I am sorry, I am not going to say anything more. The Government will have the opportunity of vetoing the agreement, consequently the opportunity will always be there. I cannot put it clearer than that. We have got, not only to maintain the dye industry in this country, but we have somehow or other got to bring down the price of dyes to something like the level they were at before the war. That is the difficulty. The problem is how to get prices down as well as the work carried on in this country. Reparation dyes are not allowed to be exported, and they are not sold to the British Dyestuffs Corporation. The British Dyestuffs Corporation is an agent in selling them in conjunction with a committee representative of the colour users and various independent people, and presided over by the hon. member for Stretford (Sir T. Robinson), who has given an extraordinary amount of time and service to this work without any remuneration. If a dye comes in as a reparation dye, the full value belongs to the British Government.

Mr. BLACK: I called the right hon. gentleman's attention to the fact that in his own statement 8,274 cwts. at 3½d. a lb. were being sold to-day in this country at 1s. 5d. a lb.

Mr. WEBB: Nobody is entitled to get that dye at 3½d. a lb. The whole matter is one for the consideration of this Committee and can be brought up.

Lieut.-Commander KENWORTHY: The new profiteering Committee!

The Preparation and Use of Liquid Oxygen

Items of Interest at the Refrigeration Congress

Among the papers presented at the International Refrigeration Congress, which was held in London from Monday, June 16, till Friday, were a number of chemical and engineering interest, and abstracts of those dealing with liquid oxygen are given below. Others will be given next week.

Liquid Oxygen Apparatus

FOUR short papers on (1) "Progress made since 1913 in Liquefaction of Air and in Separating Atmospheric Constituents by Liquefaction"; (2) "Liquid Oxygen Apparatus"; (3) "Purification of Air and Gases for Liquefaction"; and (4) "Accidents in Oxygen Apparatus," were contributed by Mr. C. R. Houseman (of the British Oxygen Co., Ltd.) on Thursday, June 19. In the absence of Mr. Houseman, the papers were presented by Dr. E. Fyleman.

The first paper consisted of a brief account of progress made since 1913 in connection with the liquefaction of air and the separation of its constituents, which, it was stated, had been chiefly confined to details of construction and improvements in the production of argon. The author discussed the modification of the Claude system by Heylandt, which modification relied upon an expansion in an engine from 200 atmospheres. He then went on to the extraction of argon, by Linde in 1914, from impure liquid oxygen, by submitting it to a further rectification in a second column, and the modification of this process by Filippo (who arranged the second column within the air rectification column) in 1915, and by Claude in 1917.

Dealing with liquid oxygen apparatus, the author stated that the most efficient Linde type of liquid oxygen plant was dependent on simple nozzle expansion, combined with a high pressure cycle and pre-cooling. Considering first liquid air, Dr. R. Linde had given the output of a plant, in which 100 cub. metres of air entered the main interchanger at 15° C., and where expansion was from 200 atm. to 1 atm., as 1·56 h.p.h. per lb. In conjunction with an ammonia machine lowering the admission temperature to —45°C., the yield became 1 lb. per 9 h.p.h. Another plant was one introduced recently by the Société de l'Air Liquide, in which nozzle expansion from 200 atm. was combined with engine expansion, from 2–3 atm., the rectification column working under this latter pressure. A larger and more efficient plant, also by the same company, was one in which expansion from 40 atm. with production of external work took place in two stages, and where liquid nitrogen was employed as the scrubbing agent.

Purification before Liquefaction

As to the purification of air and gases for liquefaction, the author discussed the abstraction of CO_2 from the air treated, by the use of lime or caustic soda. The most economical method of removing CO_2 from air, if floor space were available, was by the passage through layers of lime, or, better, lime treated with a solution of caustic soda. The removal of water was effectively performed by refrigeration, and a table was shown to demonstrate that low temperatures were much more effective in removing moisture than the possible chemical reagents such as calcium chloride and caustic soda.

In the fourth paper, dealing with accidents in oxygen apparatus, the author dealt with the experiences of the British Oxygen Co. in this connection. A few years ago explosions in their plants were becoming alarmingly frequent, and investigations were started to ascertain the cause. Several of the cases investigated were unquestionably due to contamination of the ingoing air by acetylene; but in a few cases no acetylene had been used in the factory, and yet the explosion was closely similar. The lubricating oil was, however, suspected, and the compressors supplying the air in these cases were carefully examined. Experiments proved beyond doubt that when lubricating oils were heated in the presence of compressed air they ultimately broke down into simpler substances, such as acetylene (or bodies with properties similar to those of acetylene—e.g., yielding explosive silver compounds) and free carbon, at temperatures which could easily be reached in a compressor with adequate water cooling. The lubricating oil used gave acetylene when heated to about 350° C., in the presence of air at a pressure of 30 atm., and experiments on other lubricating oils gave similar or even worse results.

Liquid Oxygen Explosives

Dr. E. Fyleman, who presented a paper on "Liquid Oxygen Explosives," pointed out that prior to the discovery of these, all explosives suffered from the disadvantage that the methods adopted for supplying the necessary oxygen for combustion involved a considerable absorption of energy, as free oxygen had to be provided by the decomposition of the original molecules of the explosive. Again, from the time they left the works until actually used, such explosives had to be handled and stored with great care; there was danger of a cartridge failing to explode, and remaining as a potential source of danger in the borehole; many of the materials evolved carbon monoxide, nitrogen oxides and other noxious gases on explosion; and, on account of the complicated and potentially dangerous methods of manufacture, which involved highly skilled supervision, the most effective of such explosives were expensive.

Liquid oxygen explosives depended on the oxidation of charcoal or other combustible material by means of liquid oxygen. Thus, the whole heat of combustion of the organic matter was available. It might be supposed, at first glance, that the heat absorbed by the gasification of the liquefied gas, together with that necessary to heat the whole of the materials from —183°C. (the boiling point of liquid oxygen) to atmospheric temperature would seriously detract from this advantage, but this was the case to an almost negligible extent only.

The author dealt briefly with the history of liquid oxygen explosives since they were first used by von Linde in 1897 in connection with the boring of the Simplon Tunnel, and their subsequent use in iron mines, etc.

Modern Practice

In modern practice, cartridges were wrapped in paper and contained a porous, combustible or partially combustible filling. This consisted of some more or less porous form of charcoal, such as wood charcoal, cork charcoal, lamp black or soot, but cork meal and sawdust were also used. These fillings were very hygroscopic, and the cartridges must be stored in a dry place. Petroleum was also used, absorbed in kieselguhr in order to ensure intimate admixture with the liquid oxygen. Powdered aluminium was frequently added when a very high brisance was required.

The liquid oxygen was transported and taken down the mine in containers of various capacity from 5 to as much as 100 litres of liquid. The containers were usually made of spun copper, but sometimes of brass. They consisted of two concentric hollow spheres, each provided with a long neck, the upper ends of the inner and outer necks being joined, so that in effect a double-walled flask was obtained, each wall being built up of sections with soldered joints. The inner flask was fitted with a perforated false bottom which contained highly porous charcoal. The space between the double walls was evacuated through the outlet tube, the flasks being heated meanwhile to the highest temperature which the solder would stand; the outlet tube was then sealed and the cap permanently fixed into position. When liquid oxygen was filled into the inner vessel the charcoal was intensely cooled, and the effect was to improve the vacuum in the interspace between the double walls by the well known Dewar effect, to such an extent that the heat absorption by gaseous conduction and convection became almost negligible, and such heat energy as was absorbed was mainly due to conduction down the metallic walls of the neck. These flasks were protected by an outer casing of sheet iron, the interspace being filled with an insulating lagging. At the working face the liquid oxygen was transferred as required to soaking vessels of analogous construction but of cylindrical form with vertical sides, varying in size from about 4 in. internal diameter upwards, and provided with a loosely fitted lid. In these the cartridges were soaked, usually for about 10 minutes, and when soaked they sank in the liquid. They were then transferred to the bore-

hole, for which operation they could be seized with the bare hand without injury; the bore-hole was quickly tamped and the charge fired, either with a detonator or with an ordinary fuse. A much more shattering effect was produced in the former case, but, of course, the use of ordinary detonators to some extent lessened the advantages of safety and simplicity of working, in stores and elsewhere, with which the use of liquid oxygen explosives was more particularly associated. Twenty minutes after charging, the cartridges were usually considered to have become perfectly harmless through evaporation of the oxygen, so that after half an hour all danger from misfire was considered to have vanished.

In dealing with the actual practice in the use of liquid oxygen explosives in mines in Germany, Lorraine and Mexico, Dr. Fyleman gave some interesting figures in connection with the Lorraine iron mines, particularly as to the saving in cost, which was on the average 30 per cent. compared with the brown powder formerly used.

The "Chemists' Exhibition"

Twenty-seventh Annual Display of Pharmaceutical Products

PRIMARILY intended for the pharmaceutical retailer, the twenty-seventh "Chemists' Exhibition," which opened at the Central Hall, Westminster, on Monday, contains only a few items of interest for the chemical manufacturer. Taken as a whole, however, it is an excellent example of a trade fair. The exhibition has been organised by *The British and Colonial Pharmacist*. There is to be found the usual array of soaps, perfumes, patent and toilet preparations usually associated with the modern druggist's shop, all very tastefully set out. Among these exhibits Howards are showing their new synthetic menthol which differs from the natural product only in being optically inactive and having a slightly lower melting point. W. J. Bush and Co. also have a representative display of organic fine chemicals. Glass bottles of a large variety of shapes, colours and sizes are shown by the United Glass Bottle Manufacturers, Ltd., and by Beatson, Clark and Co., Ltd., of Rotherham.

Certain interest attaches to what may be termed the pharmaceutical engineering machinery, in the form of tableting and bottle-filling machines. Thomson and Capper, Ltd., of Liverpool, are showing a variety of tablet-making machines of different sizes and capacities, capable of dealing with up to 700 tablets per minute in the large sizes. Roberts' Patent Filling Machine Co., who are well-known specialists in bottle-filling machinery, have a comprehensive exhibit of different types. Many of these are based on the balance principle, when the required weight has run into the bottle the dropping of the scale pan electrically cuts off the supply of liquid. In some types the whole of the operations are automatically controlled, and in others the liquid is switched off by hand when the bottle is full. There are machines for all kinds of liquids, mild corrosives and viscous oils included. Another device displayed on the same stand is the Vacu-Filter, a simple hand-pump-operated vacuum filter, which is capable of rapid work on a small scale.

National Physical Laboratory

Annual Visit of Inspection: Work of the Chemical Department

THE annual reception of the National Physical Laboratory was held on Tuesday at Teddington, the guests, who numbered about 1,000, being received by Sir Charles Sherrington, President of the Royal Society and Governor of the Laboratory, Sir Arthur Schuster, F.R.S., and Sir Joseph Petavel, Director of the Laboratory. The laboratories were thrown open to general inspection, and a number of demonstrations were arranged. The greater part of the buildings are, of course, devoted to physical work on aerodynamics, engineering, electrical and optical instrument testing, standardisation of weights, measures and chronometers, etc., while the William Froude Tank for hydrodynamic experiments proved a very attractive feature.

There is a small and efficient chemical department principally used for iron and steel analysis carried out in connection with the metallurgical department, or on behalf of outside firms who either do not possess laboratories of their own or desire to check their routine determinations.

The methods of determining carbon and sulphur in steel were demonstrated in the chemical department. In each case a rapid method is normally used, but in some instances the sample is not amenable to the standard methods and longer and more complex determinations are required. Carbon is determined by heating the sample in an electric combustion furnace in a stream of oxygen, and the CO_2 evolved is collected and weighed. This process takes less than 40 minutes, but is not always suitable. Sulphur is determined, normally, by a wet volumetric method, in which it is entirely converted to H_2S which reacts with cadmium acetate. The resulting sulphide is oxidised with iodine solution and the excess titrated with thiosulphate. This method is very rapid and in the majority of cases very accurate, though again it is not suitable for all samples.

Another exhibit in the chemical department was of seven standard steels prepared in connection with the British standards movement and tested by the laboratory. These are intended for use as checks in metallurgical laboratories, and they are supplied through the usual dealers at a uniform cost of one guinea per 50 grammes. These samples, which are, of course, guaranteed uniform, at present cover steels with definite percentages of sulphur (2), phosphorous (2), carbon (acid and basic steels), and manganese. The seventh standard is a typical cast-iron.

The Future of Magadi Soda

Brunner-Mond Scheme Accepted

UNDER the compulsory winding-up order recently made against the Magadi Soda Co., Ltd., Mr. H. E. Burgess, Senior Official Receiver in companies liquidation, has now obtained the leave of the court to call meetings of the company's debenture-holders, creditors, and shareholders to consider proposals for selling the property to a new company to be formed by Brunner, Mond and Co., Ltd.

At the date of the winding-up order there were two schemes of reconstruction before the creditors and shareholders, one being by Brunner, Mond and Co., Ltd., and the other by a firm of underwriters, but there were difficulties in the way of each proposal.

It is understood that, after considerable negotiations, the scheme put forward by the firm of underwriters has been withdrawn in favour of Brunner, Mond and Co.'s proposals, which have been modified in favour of some of the parties, and that the consent of the Colonial Office, as the company's landlords, has been obtained to the granting of a new lease to the new company on terms which have been agreed by Brunner, Mond and Co., Ltd., and which appear to the Senior Official Receiver to be satisfactory.

Under the scheme the first debenture-holders will receive debentures for the same amount as in the old company, and at the same rate of interest. The second debenture-holders and the general body of creditors are to receive fully-paid preference shares, while the shareholders will receive fully-paid second preference shares, with the right to subscribe for another class of preferred shares carrying a higher rate of interest. Brunner, Mond and Co., Ltd., have undertaken to provide the necessary working capital, and have given guarantees satisfactory to the Senior Official Receiver and to the Colonial Office as to the extent to which they will work the undertaking.

The notices calling the meetings will be issued in about three weeks' time, and, owing to the distance at which some of the parties reside, the court has directed that the meetings are to be held three months from that time.

Chemistry and Fuel Economy

MR. H. W. BANNISTER, manager of the Feed Water Specialists Co., is now on a visit to America with a view to obtaining further information for securing economies in steam raising. Prior to his departure he was entertained by the convention of district engineer representatives attached to the company. Mr. W. H. Crowe, of the Andrew Maxwell Co., referred to the appreciation by steam users of the research in colloidal chemistry carried out by the laboratory staff under Mr. Bannister's direction. The reduction of the laboratory tests to simple demonstration enabled works managers and engineers to note how the adoption of colloidal principles produced substantial gains from increased power and lower fuel and repair costs.

Reviews

TEXTBOOK OF CELLULOSE CHEMISTRY. By Emil Heuser translated from the second German edition by C. T. West and G. J. Esselen, Jr. London: McGraw-Hill Publishing Co., Ltd., 1924. Pp. xi, 212. 12s. 6d.

In cellulose chemistry such a mass of facts has accumulated that it requires a well-informed, clear-minded, unprejudiced and patient man to classify the available material and courageously draw definite conclusions. Whether the author is that person remains to be seen, but in any case the present volume presents an attempt in the right direction. Cellulose is treated from every point of view both scientifically and technically. The book is interspersed with a number of small experiments, or rather indications of experiments—a very good point, which might be extended still further, and which considerably facilitates the reading; unpleasant details are omitted. The book gives a concise and lucid account of a difficult subject and, provided the reader will use discretion, he should obtain a grasp of the subject which may form the basis of some good work. There are, however, views which should be treated with care. That lignocelluloses and pectocelluloses are merely impure forms of cellulose will take a good deal of swallowing. The author's case becomes still weaker when, in support of these ideas, he arrays his experiments against those of Cross and Bevan. In this connection, page 9 of the volume presents curious reading, but we can give no more than a few lines :—

"Because of the prejudice of the individual investigators, sufficient efforts have not been made to free cellulose from all of its impurities; investigators have been satisfied with impure products and have drawn conclusions concerning cellulose itself from reactions which were obscured by these impurities. A typical example of this is seen in the views concerning the nature of the cellulose from cereal straws. The English cellulose investigators, Cross and Bevan, to whom we are indebted for the foundations of a cellulose chemistry, believed the cellulose isolated from straw to be a special type or a special member of the oxycelluloses."

We are sure that every unprejudiced student of Cross and Bevan's researches will resent this unjustified attack on our great British investigators.

There is another weakness of this volume. A reader ignorant of the chemistry of cellulose might conclude that nearly all recent work has been carried out by German chemists. The great majority of footnotes refer to German publications, and even the references to the work of Cross and Bevan—the founders and developers of cellulose chemistry—is limited to their monographs and with one or two exceptions to their papers in German journals only. The very important work of Irvine and Hirst is barely touched upon. On the other hand, the translators have performed their part in an admirable manner. The book reads very easily, is well edited and printed, and, in spite of the faults which we have pointed out, is a volume deserving the attention of everybody interested in these difficult and important problems.

S. P. S.

THE SPECIFIC HEATS OF GASES. By J. R. PARTINGTON, M.B.E., D.Sc., and W. G. SHILLING, M.Sc. Pp. 252. London: Ernest Benn, Ltd., 1924. Price 30s. net.

In this book the authors have endeavoured to collect all available data and information relating to the specific heats of gases and to correlate such data as can reasonably be regarded as substantially accurate. So far as the reviewer is aware, no similar book has hitherto been published, although many text-books devote a few pages to the subject. Many problems connected with internal-combustion engines, explosives, and fuel economy cannot be solved without a knowledge of the specific heats of gases, and investigators in many fields will welcome the appearance of this volume. It is not intended for elementary students, nor has it been written to cover any particular course of study, but it will be of great value to the many highly skilled workers who have to undertake investigations in which the specific heats of gases are concerned.

The book is divided into six chapters and includes sixty tables relating to specific heats and allied subjects. It contains 48 illustrations, including several charts, and concludes with a bibliography and index. The first chapter defines specific and molecular heats and discusses equations of state, the second describes methods for the determination of the specific heats of gases, the third deals with the effect of temperature upon the specific heats, and the fourth with the effect of pressure. One section of chapter IV. is devoted to steam, and another to the specific heat of a dissociating gas. The fifth chapter discusses the application of knowledge concerning specific heats in the working of internal-combustion engines, furnaces, gas producers, and refrigerators. The final chapter is reserved for expositions of various theories relating to the specific heats of gases and includes discussions of the kinetic and the quantum theories.

A great amount of labour must have been involved in the production of the book, and it will probably soon become generally accepted as the standard book of reference on the subject.

H. F. H.

French Chemical Industry Notes

[FROM OUR PARIS CORRESPONDENT.]

THE fourth Congress of Chemical Industry (Congrès de Chimie Industrielle), which commenced its sittings in Bordeaux on June 16, has included not only instructive communications and discussions, but visits and inspections. An interesting trip was that made by boat to the Gironde Dockyards, the 150 visitors including M. Gall, president of the Congress (in the absence of M. Dior, president of the Société de Chimie Industrielle); M. Jean Gérard, general secretary of this Society; M. Jean Voisin, assistant secretary, and numerous foreign delegates, amongst them being M. Jean Flahaut (Canada) and MM. Seidel and Tanner, of the American Chemical Society. The manager and engineers of these famous *Chantiers Maritimes* showed the delegates the ships in construction, and the workshops.

The great Bordeaux Flour Mills (les Grands Moulins)—a model of their kind—offered many striking features, one of the most remarkable being an apparatus for determining automatically the degree of moisture of grain. This apparatus was said to be adaptable to all chemical industries in which it is necessary automatically to ascertain the proportion of humidity.

An afternoon was devoted to the reading of numerous informative papers. M. Dupiré presented to the fermentation industry section a new apparatus by means of which continued diffusion can be most efficaciously applied to the extraction of beet sugar. With this invention a force of 6 h.p., instead of 28, is sufficient to treat 400 tons of roots. In the Tannery section M. Parsy, one of the chief engineers of the French company of Dyeing and Tanning Extracts (Havre), contributed an authoritative paper on utilisation of the extract of mimosa bark in the tanning of glossy leather. In the Resin section, the president, M. Dupont, revealed a method of industrial realisation for the manufacture at a low price, and the purification, of abietic acid.

M. Jean Gérard, on behalf of the French Societies of Expert Chemists, reviewed the diverse properties of the commercial products at present sold under the name of spirits of turpentine. He emphasised the need for a definition based, not so much on the origin of the product as on a knowledge of its characteristics. It was indispensable that spirits having the right to be called "turpentine" should be easily distinguished. It is not very often possible to determine the process of manufacture, and identification by the physical and chemical characteristics is the only one that can generally be practised.

The section agreed, and formally recorded its desire that, in order to distinguish the true spirits of turpentine from the *essence* obtained by the distillation of dead timber (Swedish turpentine), the title of "pine spirits" should be henceforth reserved for the latter.

In the liquid combustibles section M. Pique gave an interesting description of alcohol dehydration, which for two years past has been the object of much research. In the photographic products section MM. A. Lumière and Seyewetz dealt with selenium toning, and M. Guntz explained the principle of a new process of infra-red photography based on the use of zinc blende with orange-yellow phosphorency.

The *Société Alsacienne des Produits Chimiques* announces a credit balance for 1923 of frs.1,823,231 instead of the deficit

of previous periods. At the general meeting on June 19 this improvement—obtained during the last seven months of the financial year (the resumption of normal working dating only from June 1, 1923)—was well received. A sum of 675,872 frs. was voted to the expenses of researches, experiments and laboratory fitting. The Mulhouse factory has now been extended and its turnover doubled. The manufacture of synthetic camphor, abandoned in 1922, has been resumed. A new factory is being constructed near Brest for the extraction of iodine from kelp and other seaweeds.

The general meeting of the *Société Anonyme d'Explosifs et de Produits Chimiques* showed a gross profit of 3,763,407 frs. for 1923. After the usual deductions for interest and sinking fund, there remained 3,078,032 frs., which were thus allotted :—a gross dividend of 18 frs. 67 centimes to capital shares ; 15 frs. to the ordinary scrip, and 21 frs. 42 c. to founders' shares. The report announced that the output of the Saint-Martin-de-Crau and Billy-Berclau factories had been developed, and that the sales of distilled glycerine and explosives had expanded. In Italy the company was also busy. To allow of a more economical grouping of the various Italian services, the latter had been transferred from Turin to the Villa-franca-in-Lunigiana factory. In consequence of the increased demand for glycerine and explosives the Board contemplates an early increase in the capital of the company, which at present stands at 12,000,000 frs. The firms in which the company participates include, according to the report, the Explosives and Chemical Products, Ltd.

Gas Companies' Right to Manufacture Chemicals for Own Use

Court of Appeal Decision

IN the Court of Appeal on Friday, June 20, a judgment by Mr. Justice Astbury in the case of Deuchar *v.* The Gas Light and Coke Co., declaring the company to be entitled to manufacture chemicals for their own use, was upheld and the plaintiff's appeal dismissed.

The Issues in the Action

In the original action the plaintiff, Mr. John Lindsay Deuchar, was secretary of the Kastner-Kellner Alkali Company, and for the purposes of the action he acquired stock in the defendant company. He asked for a declaration that the manufacture by the company of any chemical or other substance necessary, or convenient for the treatment, compounding, conversion, or otherwise rendering marketable any products, refuse, or residue, arising or produced by the making of gas by the company, or the erection by the company of any factory or buildings for the purpose of such manufacture and erection, were *ultra vires* the company, and for an injunction to restrain such manufacture or erection. The substances were caustic soda and chlorine, which the company were manufacturing, and had for the purpose erected a factory. Caustic soda was required by the company for the treatment of naphthalene, one of their residuals, and chlorine arose necessarily in the manufacture of caustic soda.

The company carry on their business under a number of private Acts of Parliament, of which the Gas Light and Coke Company Acts, 1868 and 1876, are most pertinent to the question. By section 40 of the Act of 1868 the company were authorised " to make and supply gas, and to convert, manufacture and deal with, sell, and dispose of coke, tar, coal, pitch, asphaltum, ammoniacal liquor, oil, and all other products, refuse, or residuum arising or produced by the making of gas." By section 64 of the Act of 1876 the company were authorised to purchase and maintain appliances, and to use all such works for dealing with residuals as they might require or deem necessary or expedient for efficiently and economically carrying on their undertaking.

The company for some years had purchased caustic soda for the purpose of converting naphthalene into beta-naphthol by the electrolytic process, which they stated was the most economical and best for dealing with naphthalene. They alleged, however, that the prices charged to them for caustic soda were unreasonable and excessive and that, with a view to economy and efficiency, it was expedient to erect a factory on their own land to manufacture caustic soda in such quantities as were required for the treatment of naphthalene. In the manufacture of caustic soda it was necessary that chlorine would result as a by-product, and it was used for the treatment of other residuals. They did not intend to make caustic soda in larger quantities than they required for that purpose, or to sell or dispose otherwise of caustic soda or chlorine.

The plaintiff alleged that the company had no power to manufacture caustic soda, but must buy what they required from the chemical manufacturers.

Mr. Justice Astbury said that a wide meaning must be given to the word " manufacture " as used in the Acts under which the company existed. There was nothing in the Acts which expressly prohibited manufacture, and it was fallacious to say that the making of a necessary article was a separate business. The company were doing nothing *ultra vires* and the action must be dismissed.

Court of Appeal's Judgment

The Master of the Rolls, in giving judgment, said that one of the residuals arising from the making of gas was naphthalene. The ordinary commercial method of utilising naphthalene was to convert it into beta-naphthol by a process which required caustic soda as a reagent. Formerly the Gas Company purchased this. Now they had decided that it would be cheaper and more economical to make their own caustic soda, and they had erected plant sufficient to supply their own requirements of this chemical, but no more. Incidental to the production of caustic soda they produced chlorine. But that did not affect their power to make caustic soda. There was the authority of Lord Selborne for saying that the powers of a statutory company must be ascertained by reference to the Act creating it and those which it exercised must be expressly conferred or derived by reasonable implication from that statute. On the other hand, the doctrine of *ultra vires* must be reasonably and not unreasonably applied. Any business undertaken must be consequential on or incidental to a company's statutory powers. It was clear that the purposes and business of the Gas Light and Coke Co. was two-fold—to make gas and to dispose of the residuals which had resulted from the process of making gas. It was not denied that the proper method of utilising naphthalene was to convert it into beta-naphthol and to do so caustic soda was needed. It must be provided. There being nothing to limit the right of provision and no express prohibition against manufacture, it would be taking too narrow a view to hold that the making of caustic soda lay outside the powers of the company.

Lord Justice Warrington said that the company had express powers to convert naphthalene into beta-naphthol. They had by implication the power to provide caustic soda. A proper and reasonable means of providing it was to make it. Therefore they had power to make caustic soda.

Lord Justice Sargant concurred.

The appeal was accordingly dismissed.

Canadian Molybdenite Deposits

A REPORT by Dr. M. E. Wilson, of the Geological Survey of Canada, on the geology and mineral deposits of an area in the vicinity of Arnprior, Ontario, and Quyon, Quebec, including parts of Fitzroy, McNabb, Onslow and Bristol townships, has just been published. The area is underlaid in great measure by formations of Precambrian age. These are concealed at some points near Ottawa river by Palaeozoic limestones, dolbmites and shales. The report contains descriptions of a number of mineral deposits including deposits of molydbenite from which the greater part of the war-time production of this mineral in Canada was derived ; the Bristol iron mine which was worked intermittently from 1873 to 1894, and the Kingdom lead mine, Galetta, which has been worked continuously since 1914 and from which more than four and a half million pounds of lead was produced in 1923.

Recent Wills

Sir James Reckitt, of Swanland Manor, Hull	£480,839
Mr. Frederick Wissler, Shooters Hill Road, Blackheath, chairman of the Tharmaco Chemical Products Co., Ltd.	£79,856
Mr. Robert William Burden, Park Avenue, Ashton-on-Mersey, Cheshire, of Jurgens, Ltd., margarine manufacturers	£7,122

No Right to Maintenance.—(VIII)

Socialistic Claims Which Would Lead to Suicide—The Truth About the Demand for Work—Forgetting the Customer

By Sir Ernest Benn

THOSE of us who can carry our memories back a quarter of a century or more cannot fail to experience a sense of satisfaction when we contemplate the arrangements that have been made in this land of ours to avoid the horrors, which were formerly common, of men and women perishing through want and children going hungry to school. It is of the first importance that we should all understand what it is that makes these arrangements possible, that we should comprehend the economic basis upon which they rest, and that we should not allow ourselves to be deceived, or drift into a frame of mind which might undermine the whole social fabric and bring us to a worse condition than that from which we have escaped. Life is a constant struggle with the forces of nature, and only by maintaining in the most vigorous way our part in the struggle can we win from nature the nourishment we need and those amenities which, in ever-growing quantities, are regarded as necessities. If effort is relaxed—if, indeed, we forget that there is the necessity for exertion—we place ourselves in danger

An Unsound Claim Exposed

As human beings we have no right to anything that we will not ourselves produce, and it is proper subject for study and argument as to what sort of incentive is required to make us perform the necessary duties of production. To say that we have any rights in this matter of maintenance may sound attractive and may appear to be in line with the political notion of a man's position in the world, but it is contrary to the real truth, namely, that all we have is responsibilities.

Socialists claim " work or maintenance "—sometimes even work or maintenance at full trade union rates—and claim it as a right. Let us see how fallacious that claim really is. Suppose we imagine a community consisting of ten men. One man becomes diseased or incapacitated, and the nine men remaining, out of the goodness of their hearts, say that they will maintain him. They submit to a tax of one-ninth of their income in order to make provision for the tenth man. That puts no hardship upon anybody; it is a practical, a charitable and a humane arrangement. If a second man finds himself unable to pursue his vocation and the community still takes the view that all are responsible for each, then the eight remaining workers would have to submit to a further tax in order to maintain the two who could not work. The burden becomes greater as the out-of-works increase, and if, presently, the stage is reached that we have now reached in this country to-day, and a party arises which says " We have the right to maintenance," it is obviously only necessary for the whole ten to accept that view for every bit of maintenance to disappear.

Economically the maintenance idea leads to straightforward suicide. The man who talks of charity or human kindness in these days of political " rights " is considered out of date, but it cannot be long before it is again recognised that any measures taken by the public for the assistance of those who may be in temporary difficulties are—whatever they may be called—nothing more nor less than charity, and that the attempt to get away from this idea will, if persisted in, lead us to disaster.

There is a very general feeling that it is desirable to remove the taint of pauperism from public assistance, that it is right to wipe away any trace of stigma from such things as doles, and we are encouraged to regard these things as belonging as of right to a citizen—an attractive notion which we should all be very glad to endorse if it were not for the knowledge that it has only to be accepted widely enough to bring our society to an end. Fortunately, there is in each of us a sufficient sense of right and an instinctive desire to work which saves us from the damage that our own political folly would otherwise do to us.

The Demand for Work—On Terms

When we examine still further this demand for work or maintenance we begin to see how far from the path of economic truth we are travelling. The trade unions on the one hand and scientific organisation in industry on the other have developed a state of affairs which, if properly understood and used with sense and understanding, is full of potentiality for good for all of us, but which is to-day being used for highly destructive purposes.

The demand for work is not for any work, it is for work on our own terms, at our own trade, in our own way. If a carpenter is out of work the demand is that he should be maintained until there is more carpentering to be done, and we have developed a system of organisation which actually forbids the carpenter to do anything but carpentering. It is necessary to get back to first principles, to think these things out afresh and to ask ourselves why we work and how work arises.

The only excuse for the existence of a carpenter is that his fellow-citizens require carpentering to be done. The carpenter does not toil with wood and saw for the pleasure of it, or for his health; he does it because his neighbours require wood to be sawn, and if he will saw wood to their satisfaction they are willing to give to him out of their production other things upon which he can live. That being so, the position arises when the carpenter's fellow-citizens say, " We do not require any more carpentering just now, but we do want a little digging done." Obviously the carpenter, if he is a true citizen, desiring to do his share of the general work of the community in providing comfort for all, will put down his saw, pick up a spade and fill up his time with digging. He can certainly have no rights upon his fellows unless he is prepared to do any reasonable form of service that his fellows require, and yet, in these enlightened days, we have permitted a system to grow up amongst us which limits each one of us to some highly specialised function, which forbids us to do anything but one job, which calls us " blacklegs " if we move to the right or to the left from the narrow path that has been allocated to us. Then we say we must have work or maintenance! Could anything be more absurd?

The Way to View Work

The trouble is, as I have said before, that we look on this question of work upside down. We regard work as an end in itself—as something which the worker must have for his own benefit. We think only of the worker; we have almost forgotten the job which he does and completely forgotten the person for whom he does it. We must get back to a totally different point of view. We must keep our minds fixed upon the purpose of the work and the consumer of the work. We must start with the fact that we work to serve others; that if others had no wants there would be no work for us, and that if we do not render good service and give satisfaction to the others, we are failing in our duty.

Such a point of view leads to all sorts of interesting and old-fashioned notions which need to be revived. If each of us, in doing a piece of work, would ask ourselves whether we are giving satisfaction, whether we are giving good value, whether we are creating in the minds of the consumers a desire for more, then the unemployment problem would disappear and the absurd doctrine of the right to maintenance with it.

These are questions which all of us need to ask ourselves—not only the working man, but the manufacturer, the merchant, the wholesaler and the retailer. The mentality which allows us to ask how long we can take over a job and how much we can squeeze out of it for ourselves is far too common amongst us. It creates at the other end of the scale—in the breast of the consumer—a feeling of irritation and dissatisfaction, a determination to do without us as far as possible, it kills trade, reduces demand and creates unemployment. Having worked ourselves into this wholly false and most unfortunate position, arising from our own stupidity, we turn round and say to the very persons whom we have declined to serve that we have upon them some right to maintenance. We want to hold as long as ever it is possible—and it should always be possible if we act rightly—the proud tradition that in our land no man shall starve, but we are jeopardising the continuance of that position if we allow ourselves for one moment to entertain the notion that there is any right in the matter. We all have grave responsibilities and we should concentrate on these.

Chemical Matters in Parliament

White Lead Convention

In reply to a question by Mr. E. Brown (House of Commons, June 19), Mr. Henderson said that the ratification of the Convention is supported by master painters, operative painters and building trades' operatives. It is opposed by the white lead manufacturers, workers in white lead factories, the Federation of Building Trade Employers, and the paint and colour manufacturers.

The following bodies have sent representations regarding the Convention :

In favour of ratification—

The Master Painters' Federations of England and Scotland, the Painting Trade Materials Committee of Great Britain and Ireland, the Painters and Decorators Industrial Joint Council of Great Britain, the National Amalgamated Society of Operative House and Ship Painters and Decorators, the National Federation of Building Trades' Operatives.

Against ratification—

The Association of British Chambers of Commerce (forwarding a pamphlet by the Building Trades' Employers), the London Chamber of Commerce, workers in twelve individual white lead factories, the Workers' Side of the Joint Industrial Council for the Lead Manufacturing Industry, the Workers' Side of the Joint Industrial Council for the Cooperage Industry, the National Confederation of Employers' Organisations on behalf of white lead makers, the National Federation of Building Trade Employers of Great Britain and Ireland, the Lead Employers' Council the National Federation of Associated Paint, Colour and Varnish Manufacturers of the United Kingdom.

Lead Paint Bill

Mr. Rhys Davies (House of Commons, June 20) moved the second reading of the Lead Paint (Protection against Poisoning) Bill. An amendment for rejection was, after considerable debate, withdrawn, and the Bill was duly read and committed to a Standing Committee.

Magnesium Chloride

Mr. Hannon (House of Commons, June 23) asked the Under Secretary for India whether he was aware that application had been received by the Indian Tariff Board from the magnesium chloride industry requesting that protection should be afforded to that and other industries ; and whether, since such proposed protection would operate against British export trade with India, it was the intention of the Government to come to some arrangement with the Indian Government.

Mr. R. Richards, Under-Secretary of State for India, said that he knew of such application, but the propriety of making any representations to the Indian Government could not be considered before the Tariff Board had reported.

Nauru (Phosphate Mines)

In reply to a question by Mr. Black (House of Commons, June 23) concerning preferential rights to the phosphates of Nauru, and conditions of employment there, Mr. Thomas, Secretary of State for the Colonies, said that the property rights purchased by the three partner countries from the Pacific Phosphate Company included the sole right to work the phosphate deposits in Nauru. The allotment between the three partner countries of the annual output of phosphates is governed by Article 14 of the Nauru Island Agreement. As regards the second part of the question, all matters connected with the regulation of conditions of labour in Nauru are for the Government of the Commonwealth of Australia.

Dyestuffs

In reply to a question by Mr. Graham White (House of Commons, June 24), Mr. Webb, President of the Board of Trade, said he was unable to give the relative proportion of the total manufacture of dyestuffs in Great Britain produced by the British Dyestuffs Corporation and other competing manufacturers in this country for the years 1921 and 1923.

Mr. Black asked Mr. Webb if he would state the quantity of synthetic indigo imported into the United Kingdom during 1923, and the total value at which such importations were credited to the German indemnity account, the total value debited to the British Dyestuffs Corporation and to what purpose the difference in value had been applied, and also what was the total value received by the British Dyestuffs Corporation for the sale of such importations.

The President of the Board of Trade said that probably the total importation of synthetic indigo during 1923 was 413 tons. No reparation dyestuffs were normally sold to the British Dyestuffs Corporation, but in 1922, with the approval of the users, a special transaction permitted the sale to the Corporation, of 333 tons of synthetic indigo dye requisitioned from Germany. In the absence of complete returns from the Reparations Commission, the Board was unable to furnish the value in sterling. This special parcel of indigo was sold to the Corporation at cost plus freight and charges, plus 5 per cent. on the gross cost. The difference between cost and selling price would be revealed by the Reparation Dyestuffs Trading Account. With the approval of indigo users in this country the Corporation agreed to re-sell these dyes in combination with a quantity of their own products at prices not to exceed 1s. 3d. per lb. in the case of sales to large consumers. That transaction had not been repeated.

Mr. G. White asked how the Board of Trade could consider the proposed agreement between the British Dyestuffs Corporation and the Interessen Gemeinschaft without this information.

Mr. Webb said that the Board was able to form certain estimates of production, and it was possible that further information would be obtained before any decision was made.

German Reparation Dyestuffs

Mr. Baker asked the President of the Board of Trade the total quantities of dyestuffs exported from Germany under the reparations agreements, the recipient countries, and the amounts received by each country.

Mr. Lunn gave the following statement showing the deliveries of dyestuffs as reparation to Allied Powers from the commencement up to December 31, 1923, according to the records of the Accounting Service of the Reparation Commission :—

Kilograms.—British Empire, 7,664,993 ; Italy, 6,274,601 ; France, 4,276,533 ; Belgium, 4,219,214 ; United States, 2,391,589 ; Japan, 679,313 ; Greece, 67,006 ; Serbia, 10,140. Total, 25,583,389.

A Scientific Lending Library

With the publication of a supplementary catalogue covering the years 1921-23, attention may be drawn to the circulating library of scientific books run by Lewis's Library at 136, Gower Street, London. Many chemists may be unaware of this convenient library for providing technical books without the expense of purchase. The rates for borrowing are very moderate, particularly in view of the necessarily high prices of technical works with their restricted demand. Although a technical chemist would not perhaps expect to find quite all the books in his particular subject in the library—in fact they should be on his shelves—it is when it is desired to study a book on a related subject that the advantages of a lending library become apparent. Perusal of the supplementary catalogue which has just been issued indicates that the majority of the recent books on a wide range of scientific subjects are included, with an excellent collection of works on industrial and applied chemistry.

Georgia Clays for Rubber Fillers

A study of Georgia white clays with respect to their use as fillers in rubber has been completed by technologists on the staff of the U.S.A. Bureau of Mines. The purpose of this work was to determine which Georgia clays, when properly prepared, are suitable for use in rubber compounding. Samples were collected from various deposits not now used in preparing rubber filler, as well as clay from those mines which are already producing clay for use in fillers. The samples were washed, dried, pulverised, and purified in accordance with good commercial practices, and their chemical and physical properties carefully determined. Tests were then made in commercial plants on selected samples. It was found that some of the clays were suitable for use in making high grade rubber. There was, of course, a considerable range in the properties of the different clays tested. It was shown that fineness of grain is one of the most important physical factors in the reinforcing power of the clay. Further work along this line is desirable.

From Week to Week

SIX FATAL ACCIDENTS occurred in the chemical and allied trades during May.

THE SALE of the Uridens Smelting Works, Upper Silesia, is under consideration at a price of 40,000,000 gold marks.

FOURTEEN MILLION GALLONS of paint and varnish are said to be used by the motor industry of America every year.

THE DEATH has occurred at Birkenhead of Mr. W. R. Henderson, a director of the Esperanza Nitrate Company.

AFTER BEING CLOSED for two months through strikes, the German works of the Hoechst Company are now operating full time.

THE HONORARY DEGREE of Doctor of Science has been awarded by Yale University to Dr. Banting, the discoverer of insulin.

CONSIDERABLE SALES of Swedish sulphate and sulphite are reported from Denmark, and the trade shows no signs of slackening, as anticipated.

MISS M. L. V. GAYLER, an internal student of Bedford College, has been awarded the degree of D.Sc. in chemistry, London University.

DR. KARL KREKELER, of Friedrich Bayer and Co., and a representative of the German Dye Kartel, is in New York on business and will remain there for a month.

LITTLE DANGER need be apprehended from the use of coal tar dyes frequently employed in colouring temperance drinks, says a recent report issued by the Minister of Health.

THE BORDER FACTORY of war materials at Gretna is to be put up for auction in numerous lots on July 22, 23, 24 and 25 at Carlisle. This huge settlement covers 3,000 acres.

THE R.G. TRADING CORPORATION, of 9, Farringdon Avenue, E.C.4, has acquired the sole United Kingdom selling rights of Dr. Max Lehmann and Co., manufacturing chemists, of Berlin.

THE PRESIDENT OF THE CHEMICAL FOUNDATION, Mr Francis P. Garvan, has left America on the "Berengaria" for a holiday in Europe. His wife and family are accompanying him.

GRASSELLI DYESTUFF CORPORATION, of Cleveland, U.S.A., is to take over the properties of the Grasselli Chemical Co. The new company was incorporated on June 5, with a capital of $4,000,000.

UNEMPLOYED in the chemical, explosive and allied industries during May numbered 217,470, and of these 162,840 were males. This represents about 7 per cent. of the industry for both classes of labour.

THE DEATH has occurred of Mr. Frederick William Berk, of F. W. Berk & Co., Ltd., acid and chemical manufacturers, of 1 Fenchurch Avenue, E.C.3. Mr. Berk, who died at his residence at Bromley, was aged 78.

CHEMICAL SUBSTANCES used for treating flour will be considered by the Minister of Health's departmental committee on the use of preservatives and colouring matters in food, after they have presented their primary report.

BIRMINGHAM CANAL NAVIGATION CO. has recently adopted new by-laws giving authority for the carriage of petroleum and carbide on boats on the canal. An application for confirmation of these by-laws, made at the Staffordshire Quarter Sessions, was approved.

THE TITLE of Professor of Physics in the University has been conferred by London University on Professor O. W. Richardson, D.Sc., M.A., F.R.S., in respect of his part-time appointment as Director of Research in the Department of Physics at King's College.

A GOVERNMENT CHEMIST is required in connection with the Agricultural Department in Fiji. Candidates, who must be Associates or Fellows of the Institute of Chemistry, can obtain full information from the Private Secretary (Appointments), Colonial Office, Downing Street.

THE DEATH has occurred at Leeds General Infirmary of Joseph Rothwell Hallsworth, chemical merchant, of 16, Cedar Grove, Armley. He was the youngest son of the late Mr. Samuel Hallsworth, chemical manufacturer, formerly of Amberley Road, Armley, Leeds.

APPLICATIONS FOR RESEARCH SCHOLARSHIP in dyeing, offered by the Drapers' Company, can now be made to the secretary of Huddersfield Technical College. The scholarship, tenable for one year renewable for a second year, is valued at £100 with remission of fees.

A SERIOUS FIRE occurred at the works of the National Oil Refineries Co., at Llewen, near Swansea, on Tuesday. Four tanks, each containing 200,000 gallons of washed benzene, were destroyed. The structure of the washery itself was saved and no personal injury was sustained

CHEMICAL PREPARATIONS placed on a money wallet and notes, enabled Mr. H. B. Cowper, of South Bourne, Bowdon, to charge a domestic servant in his employ with the theft of Treasury notes to the value of £10. The girl's stained fingers confirmed his suspicions, and she was subsequently placed on probation for twelve months.

THE KELVIN CENTENARY commemoration day occasioned unusual interest at Glasgow University on Wednesday. Dr. Alexander Russell, Principal of the Faraday Institute, reviewed the life and work of the great scientist, and at the close of the proceedings the Prime Minister, Mr. Ramsay MacDonald, received the honorary degree of Doctor of Laws.

THE DEATH has occurred of Mr. Charles Lorleberg, a director of R. W. Greeff and Co., Ltd., chemical merchants, of Thames House, Queen Street, Place, London, E.C. Mr. Lorleberg, of Swiss nationality, was principal buyer for the firm and was known throughout the chemical trade on the Continent. He had been connected with the firm for about 21 years, was 41 years of age, and was a member of the Society of Chemical Industry.

MR. A. C. FIELDNER, superintendent and supervising chemist of the Pittsburgh Experiment Station of the U.S.A. Bureau of Mines, Department of the Interior, sailed on June 19 for London to attend the World Power Conference and to study recent progress in safety in mines research and fuel research in Europe. The Bureau of Mines and the British Department of Mines are working in close co-operation in the development of safer methods in mining, and particularly the prevention of coal-dust explosions.

SENIOR STUDENTSHIPS for 1924 have been awarded by the Commissioners for the Exhibition of 1851 to Malcolm Dixon, M.A. (Cambridge), for research in bio-chemistry, on the recommendation of the University of Cambridge; Robert Downs Haworth, M.Sc., Ph.D. (Manchester), for research in organic chemistry, on the recommendation of the University of Oxford; and Robert Winstanley Lunt, M.Sc., Ph.D. (Liverpool), for research in physical chemistry, on the recommendation of the University of London, University College.

RED OXIDE formed the subject of a case at Bow County Court on Friday, June 20, when Hemingways and Co., colour and chemical manufacturers, of Marshgate Lane, Stratford, sued Nuroads, Ltd., of 44, Wicklow Street, King's Cross, to recover £12 13s. 3d. for red oxide supplied. There was a counter-claim for £8 10s. as damages for loss sustained owing to the red oxide being defective and unsuitable. The oxide, through lumpiness, was said to be unsuitable for the purpose of making jointless flooring. The case was adjourned for a fortnight.

Theory of Anti-Detonators

IN a paper presented at the last session of the Petroleum Division of the American Chemical Society by Messrs. F. V. Grimm and G. L. Wendt, it is pointed out that no generally satisfactory theory for the action of tetra ethyl lead as a negative gaseous catalyst in reducing the velocity of combustion under high pressure in the cylinder of the internal combustion engine has yet been proposed. The radiation theory is inadequate in many respects. The paper presents preliminary experimental results which argue in favour of an electronic mechanism. The combustion releases electrons which travel at high velocities before the flame front and seem to be responsible for detonation. The addition of tetra ethyl lead vapours to an ionised gas is very effective in reducing the number of ions present, probably by causing them to recombine. Removal of electrons by this process would serve to decelerate the velocity of flame propagation.

References to Current Literature

British

ABSORBENTS.—Absorbent and decol[illegible]ing carbons. E. R. Sutcliffe. *J.S.C.I.*, June 20, 1[illegible] pp. 635–636.

COAL.—Researches on the chemistry of coal. Part III. The extraction of coals by benzene under pressure. W. A. Bone, A. R. Pearson and R. Quarendon. *Roy. Soc. Proc.*, June, 1924, pp. 608–625.

COAL GAS.—Sulphur studies in coal gas. Part I. The removal of carbon bisulphide by a nickel catalyst. E. V. Evans and H. Stainer. *Roy. Soc. Proc.*, June, 1924, pp. 626–641.

ANALYSIS.—The estimation of the inorganic impurities in gelatin. S. R. Trotman and R. W. Sutton. *Analyst*, June, 1924, pp. 271–274.

REACTIONS.—The reaction between phosphorous acid and mercuric chloride. A. D. Mitchell. *Chem. Soc. Trans.*, May, 1924, pp. 1013–1030.

THALLIUM COMPOUNDS.—Application of thallium compounds in organic chemistry. Part I. Thallous hydroxide. R. C. Menzies and E. M. Wilkins. *Chem. Soc. Trans.*, May, 1924, pp. 1148–1152.

OPTICALLY ACTIVE COMPOUNDS.—Optical activity and the polarity of groups attached to the asymmetric atom. Part I. H. G. Rule. *Chem. Soc. Trans.*, May, 1924, pp. 1121–1134.

Investigations on the dependence of rotatory power on chemical constitution. Part XXI. The chemical significance of rotatory dispersion. H. Hunter. *Chem. Soc. Trans.*, May, 1924, pp. 1198–1206.

COLOUR.—Colour and molecular geometry. J. Moir. *Chem. Soc. Trans.*, May, 1924, pp. 1134–1141.

ORGANO-METALLIC COMPOUNDS.—Mercuration of nitrohydroxybenzaldehydes. T. A. Henry and T. M. Sharp. *Chem. Soc. Trans.*, May, 1924, pp. 1049–1060.

OXIMES.—The isomerism of the oximes. Part XVII. Some bromo- and nitro-substituted mono- and di-methoxybenzaldoximes. O. L. Brady and L. B. Manjunath. *Chem. Soc. Trans.*, May, 1924, pp. 1060–1068.

SPIRO COMPOUNDS.—Spiro compounds with reference to formation and stability. Part I. R. F. Hunter. *Chem. News*, June 20, 1924, pp. 389–393.

TAUTOMERISM.—Tautomerism with respect to nitroso-phenols. H. H. Hodgson. *J. Soc. Dyers and Col.*, June, 1924, pp. 167–174.

DYEING.—Staining and dyeing. J. F. Thorpe. *J. Soc. Dyers and Col.*, June, 1924, pp. 174–180.

LAKES.—Note on the influence of dyestuff diluent in lake making. W. E. Fearnsides. *J. Soc. Dyers and Col.*, June, 1924, p. 180.

United States

ACIDS.—Preparation of phosphoric acid. Replacement of sand by potash silicates in the volatilisation process. W. H. Ross, A. L. Mehring and R. M. Jones. *J. Ind. Eng. Chem.*, June, 1924, pp. 563–566.

RUBBER.—The chemistry of the rubber hydrocarbon. H. L. Fisher. *J. Ind. Eng. Chem.*, June, 1924, pp. 627–631.

LEATHER.—Applied research pays dividends in leather manufacture. A. G. Wikoff. *Chem. Met. Eng.*, June 9, 1924, pp. 896–901.

Effect of long contact of calfskin with saturated lime water. J. A. Wilson and E. Daub. *J. Ind. Eng. Chem.*, June, 1924, pp. 602–603.

SUGAR.—Cane sugar in Cuba. A. M. Young. *Chem. and Met. Eng.* Part I., June 2, 1924, pp. 857–861; Part II., June 9, 1924, pp. 902–906.

IRON.—The direct production of iron. Part II. E. Fornander. *Chem. and Met. Eng.*, June 9, 1924, pp. 907–910.

Diphenylamine indicator in the volumetric determination of iron. W. W. Scott. *J. Amer. Chem. Soc.*, June, 1924, pp. 1396–1398.

OILS.—The volatile yellow colouring matter in cracked gasolines. B. T. Brooks and H. O. Parker. *J. Ind. Eng. Chem.*, June, 1924, pp. 587–588.

The sodium plumbite or doctor test of gasolines. B. T. Brooks. *J. Ind. Eng. Chem.*, June, 1924, p. 588.

Specific heats of lubricating oils. E. H. Leslie and J. C. Geniesse. *J. Ind. Eng. Chem.*, June, 1924, pp. 582–583.

TUNGSTEN.—Continuous process for manufacture of sodium tungstate and tungstic acid from wolframite. N. T. Gordon and A. F. Spring. *J. Ind. Eng. Chem.*, June, 1924, pp. 555–562.

ALUMINIUM.—A revision of the atomic weight of aluminium. Part II. The analysis of aluminium chloride. H. Krepelka. *J. Amer. Chem. Soc.*, June, 1924, pp. 1343–1351.

PHOTO-CHEMISTRY.—Photochemical studies. Part II. The activation of a mercury surface by light. A possible relation between photoelectric effect and photochemical action. H. R. Moore and W. A. Noyes, jun. *J. Amer. Chem. Soc.*, June, 1924, pp. 1367–1376.

ARTIFICIAL RESINS.—The Albertol synthetic resins. Part II. E. Fonrobert and C. Marx. *Chem. Age* (N. York), May, 1924, pp. 221–223.

FERTILISERS.—Economic-chemical aspects of the fertiliser industry. *Chem. Age* (N. York), May, 1924, pp. 225–229.

COLOUR.—Colour estimation and control. S. Jordan. *Chem. Age* (N. York), May, 1924, pp. 219–220.

ANALYSIS.—Determination of nitrate nitrogen. A colorimetric method. F. M. Scales and A. P. Harrison. *J. Ind. Eng. Chem.*, June, 1924, pp. 571–572.

The determination of manganese. Part II. Manganous oxolate as a primary standard. R. W. Coltman. *J. Ind. Eng. Chem.*, June, 1924, pp. 606–609.

Accurate evaluation of potassium chlorate by the method of Bunsen. E. C. Wagner. *J. Ind. Eng. Chem.*, June, 1924, pp. 616–620.

A method for the determination of calcium carbide. J. Y. Yee and H. J. Krase. *J. Amer. Chem. Soc.*, June, 1924, pp. 1389–1393.

French

PHOSPHATES.—Contribution to the study of the simple and double orthophosphates of the metals lithium, magnesium, calcium, zinc, beryllium and aluminium. Part II. M. Travers and M. Perron. *Ann. Chim.*, May-June, 1924, pp. 298–342.

REACTIONS.—Synthesis by means of sodamide. Part XII. Action of chlorocarbonic ester on some sodium derivatives of ketones. A. Haller and E. Bauer. *Ann. Chim.*, May-June, 1924, pp. 275–297.

Action of acetylene on sodium derivatives of ketones. S. Wouseng. *Ann. Chim.*, May-June, 1924, pp. 343–416.

Action of some halohydrins on neutral sodium phosphate in aqueous solution and on some glycophosphates. O. Bailly and J. Gaumé. *Bull. Soc. Chim.*, May, 1924, pp. 590–597.

HYDRATES.—Composition of chlorine hydrate. A. Bouzat and L. Azinières. *Bull. Soc. Chim.*, May 1924, pp. 545–550.

TOWN REFUSE.—The rational treatment of town refuse. A. Bigot. *Chim. et Ind.*, May, 1924, pp. 857–872.

German

STARCH.—The constitution of the polyamyloses. (Contribution to the chemistry of starch, IX). H. Pringsheim and J. Leibowitz. *Ber.*, May 7, 1924, pp. 884–887.

Concerning the different structure of the two starch constituents. H. Pringsheim and K. Wolfsohn. *Ber.*, May 7, 1924, pp. 887–891.

REACTIONS.—The compounds of alkyl magnesium halides with carbonyl compounds and the reducing action of the Grignard reagent. K. Hess and W. Wustrow. *Annalen*, May 20, 1924, pp. 285–296.

STEREO-CHEMISTRY.—Stereoisomers of catechin. K. Freudenberg and L. Purrmann. *Annalen*, May 20, 1924, pp. 274–285.

The stereo-chemistry of the α-thio- and α-sulphonedicarboxylic acids. R. Ahlberg. *J. Prakt. Chem.*, May, 1924, pp. 241–329.

ARSENIC COMPOUNDS.—Some compounds of the diethylarsine series. N. I. Wigren. *Annalen*, May 20, 1924, pp. 285–296.

OILS.—The drying process of Chinese-wood oil. W. Schmidt. *Farben Zeit.*, June 6, 1924, pp. 1261–1262.

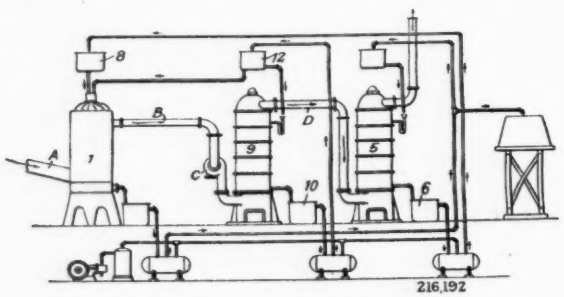
Patent Literature

Abstracts of Complete Specifications

216,192. Sulphuric Acid, Process and Apparatus for Making. W. F. Lamoreaux, Isabella, Polk County, Tenn., U.S.A. Application date, February 20, 1923.

In making sulphuric acid from sulphur dioxide, the reactions between the liquid and gaseous phase components are accelerated by bringing either or both into a state of high dispersion. To produce this dispersion, the reacting substances are treated in a high speed gas washer of the Feld type. It is necessary also to regulate the temperatures and pressures in the system, the temperature being kept between 80°–100° C. The acceleration of the reaction is due to the continuous dispersion of the liquid phase components to produce new surface films for the adsorption of the gaseous phase components, and the immediate breaking up of such adsorbed films in a rapidly repeated cyclic order.

The gas containing sulphur dioxide from the furnace passes through a flue A to a Glover tower 1, and then passes through



216,192

a pipe B and pressure blower C to a Feld washer 9, where the usual " chamber reactions " are effected, so that lead chambers are dispensed with. The residual gases pass through a pipe D to a Feld washer 5, which replaces the usual Gay-Lussac tower. The dinitrated and concentrated acid from the tower 1 is collected and cooled in a tank 2, and pumped to the tank 4 to provide the absorbing acid for the washer 5. The nitre-laden acid from the washer 5 is collected in a tank 6, and pumped to a tank 8 from which it passes to the tower 1 to be denitrated and concentrated, while the nitrogen compounds are returned to the system. The nitroso-sulphuric acid from the washer 9 is collected in a tank 10 and pumped to a tank 12 for recirculation to the washer 9. Any surplus of acid is returned to the tower 1, and water is added from time to time. In this plant, it is found that 1 lb. of sulphur can be oxidised in less than 1/10th of a cubic foot of space instead of the usual 6–12 cubic feet required in chamber acid manufacture. The reactions are also facilitated by the use of pressures up to 16 lbs. absolute. The apparatus is particularly effective for the recovery of the nitrogen compounds by absorption in sulphuric acid, but it is also possible to absorb these compounds by alkaline liquids instead of acids. Any other type of rotary or centrifugal gas washer may be employed—*e.g.*, the Theisen gas washer.

216,198. Steel, Process for the Manufacture of—and for the Fixation of Nitrogen. E. C. R. Marks, London. From The Nitrogen Corporation, 55, Canal Street, Providence, R.I., U.S.A. Application date, February 20, 1923.

In this process steel is manufactured from iron which is not suitable for use with other processes, and at the same time the carbon removed from the iron is combined with nitrogen to form a cyanogen compound. In the usual Bessemer process, the molten pig iron is subjected to an air blast to oxidise the silicon and carbon. It is found that the silicon is oxidised first in about 2–4 minutes, but the carbon requires 10–20 minutes' treatment for its removal. In this invention, the iron is treated with compressed air until the silicon is oxidised and the air supply is then cut off and replaced by nitrogen. During the period of the nitrogen blast an alkali metal, such as sodium, is added to facilitate the absorption of the nitrogen and also to react with the sulphur or the phosphorus in the iron to form compounds which are readily eliminated. To facilitate the removal of the gaseous product of the reaction, the converter is provided with a hood through which the gases pass to cooling chambers. Pure nitrogen made by the liquefaction of air is preferably used, and the remaining oxygen may be employed in a blast furnace. The nitrogen unites readily with the graphitic carbon and with the combined carbon. The nitrogen may be replaced by producer gas or any other gas containing mainly nitrogen and hydrogen, but in this case the alkali metal should be omitted, since alkali metal cyanides are decomposed in the presence of carbon monoxide and dioxide at high temperatures, to form carbonates. The hydrogen present in such gas combines with the sulphur and phosphorus. The cyanogen compounds obtained may be treated with steam to form ammonia, or may be converted into nitric acid. The process can be applied to pig iron containing a higher proportion of sulphur than can be used in the Bessemer process.

216,228. Ores and the Like, Process of Treating. W. F. Gordon and E. W. Keith, 729, Symes Building, Denver, Col., U.S.A. Application date, February 27, 1923.

The process is for treating ores and mineral concentrates containing metallic oxides, carbonates, sulphates, sulphites, etc., to dissolve out one or more of the constituents. In this invention, the solvent liquid is that known as gas-liquor or gas house liquor, which may be employed in its crude state. Such liquor contains varying quantities of ammonium sulphide, chloride, thiocyanate, thiosulphate, and ferrocyanide. If the ore contains metallic sulphides, it is calcined to convert the sulphides into sulphates or oxides, and the product is then immersed in the gas liquor. Some of the constituents are converted into basic oxides, and some go into solution. The insoluble portions are recovered as a sludge, and the solution is then distilled by means of steam or air. The vapour is condensed and recovered for use again, and the dissolved metal compounds are precipitated. The precipitates are filtered off, dried and calcined. In the application of the process to the recovery of zinc, the ore is calcined and treated with gas liquor as above, and then distilled to precipitate basic zinc carbonate. Other metals such as copper and cadmium may be dissolved out from their ores is a similar manner, while metals such as lead and the precious metals are insoluble and are recovered as tailings.

216,347. Naphthio-indoxyls, Manufacture of. O. Y. Imray, London. From Soc. of Chemical Industry in Basle, Switzerland. Application date, June 7, 1923.

To obtain naphthio-indoxyls, a thionaphthisatin or a nucleal halogen substitution product is dissolved in an alkali, producing the thionaphthol-glyoxylic acid. This acid is converted by a monohalogen acetic acid into the corresponding thioglycol-glyoxylic acid, and this is converted by elimination of carbon monoxide into the thioglycol-carboxylic acid which is condensed to the naphthio-indoxyl. Examples are given of the production of 1 : 2-naphthio-indoxyl from 1 : 2–thionaphthisatin ; 2 : 1–naphthio-indoxyl from 2 : 1–thionaphthisatin ; 4–chloro–1 : 2–naphthio-indoxyl from 4–chloro–1 : 2–thionaphthisatin ; 5–chloro–2 : 1–naphthio-indoxyl from 5–chloro–2 : 1–thionaphthisatin ; 5–bromo–2 : 1–naphthio-indoxyl from 5–bromo–2 : 1–thionaphthisatin ; 8–chloro–2 : 1–naphthioindoxyl from 8–chloro–2 : 1–thionaphthisatin ; 1–chloro–2 : 3-naphthlo-indoxyl from 1–chloro–2 : 3–thionaphthisatin, and 1-bromo–2 : 3–naphthio-indoxyl from 1–bromo–2 : 3–thionaphthisatin. All these products are used for the manufacture of dyestuffs.

216,368. Ethyl Chloride, Manufacture of. O. Y. Imray, London. From Farbwerke vorm. Meister, Lucius and Brüning, Hoechst-on-Main, Germany. Application date, June 26, 1923.

A mixture of ethylene, hydrochloric acid gas and sulphur dioxide is passed through a tube containing activated charcoal heated to 170° C. The chloride of ethyl sulphurous acid is produced, and is continuously decomposed with the formation of ethyl chloride, while the sulphur dioxide liberated can be recovered and returned to the process. The activated charcoal

can be replaced by bauxite, burnt pyrites, or terra cotta. The catalyst may be omitted, the reaction then being slower. Gases containing ethylene may be used instead of ethylene, and a pressure of 30 atmospheres may be employed.

216,450. HYPOCHLORITES, MANUFACTURE OF. The Mathieson Alkali Works, Inc., 25, West 43 Street, Manhattan, New York. Assigness of M. C. Taylor, R. B. Mac-Mullin, and R. E. Gegenheimer, Niagara Falls, N.Y., U.S.A. International Convention date, June 27, 1923.

Specification No. 195,366 (see THE CHEMICAL AGE, Vol VIII, p. 599) describes a process for producing calcium hypochlorite by extracting hypochlorous acid from aqueous solutions containing chlorides, and treating it with lime to obtain the hypochlorite. The calcium hypochlorite is extracted with water and crystallised. The quantity of lime was in excess of that necessary for the reaction. In this invention, the hypochlorous acid is in excess, and sufficient water is present to obtain the hypochlorite directly without the necessity of extracting it with water and evaporating this solution. A suspension of calcium carbonate in water is chlorinated until it contains 25–35 grammes of available chlorine per litre. The mixture is subjected to reduced pressure to remove the carbon dioxide and some of the free chlorine. The solution is then agitated with a solvent solution consisting of carbon tetrachloride containing 5 per cent. of alcohol, and the resulting solution contains about 50 grammes of available chlorine per litre. High grade hydrated lime is then treated with an excess of 30–40 per cent. of this solution, and water is slowly added to obtain a powdery product consisting of hydrated hypochlorite containing about 50 per cent. of calcium hypochlorite, 42 per cent. of water, 6 per cent. of hydrated lime, and 1 per cent. each of calcium carbonate and chloride. The product is dried, yielding a staple hypochlorite.

216,462. OXIDISED ORES OR OTHER OXIDISED COMPOUNDS OF COPPER, TREATMENT OF. G. W. Edwards and H. T. Durant, 3, East India Avenue, London. Application date, December 27, 1922.

This process is for treating the oxides and hydroxides, and also the carbonates such as malachite and azurite, silicates such as chrysocolla, basic or oxy chlorides such as atacamite. In the extraction of copper from its oxidised ores by leaching with a solution of ammonia and ammonium carbonate, difficulties are experienced where the copper occurs as a hydrated copper silicate. In the present invention, such ores are mixed with solid carbonaceous material and heated in a reverberatory furnace to 300°-400° C., the minimum temperature being that at which the carbonaceous material commences to oxidise. The heating is carried out in an excess of air and the mixture is continuously agitated. The essential point is that an oxidising atmosphere is maintained in the furnace notwithstanding the reducing action due to the carbonaceous material. The product is then crushed and leached with a cold solution of ammonia and ammonium carbonate, or it may be treated by the process described in Specification 215,802 (see THE CHEMICAL AGE, Vol. X, p. 652).

NOTE.—Abstracts of the following specifications which are now accepted, appeared in THE CHEMICAL AGE when they became open to inspection under the International Convention :—193,866 and 195,600 (Farbwerke vorm. Meister, Lucius & Brüning), relating to manufacture of azo dyestuffs, see Vol. VIII, pp. 494 and 600 ; 194,260 (Eureka Metallurgical Co.), relating to flotation processes of recovering values from ores, see Vol. VIII, p. 520 ; 198,332 (W. F. Lamoreaux), relating to manufacture of sulphuric acid, see Vol. IX, p. 129 ; 199,030 (C. Urfer), relating to catalysts for ammonia synthesis, see Vol. IX, p. 180 ; 201,927 (Buss. Akt.-Ges.), relating to production of anhydrous tin chloride, see Vol. IX, p. 402 ; 201,935 (A. Cabrier), relating to distillation of ammoniacal liquors, tars, oils, and other gasworks liquids, see Vol. IX, p. 378 ; 205,502 (Farbwerke vorm. Meister, Lucius & Brüning), relating to condensation products of the anthraquinone series, see Vol. IX., p. 693 ; 206,143 (Etablissements Poulenc Freres & C. Oechslin), relating to oxyethyl-arsinic acid, see Vol. X, p. 18 ; 206,484 (Barrett Co.), relating to purification of hydrocarbons, see Vol. X, p. 72 ; 209,703 (Compagnie de Bethune Soc. Anon.), relating to recovery of by-products of distillation of coal, see Vol. X., p. 277.

International Specifications not yet Accepted

214,628. SYNTHETIC DRUGS. L. Cassella & Co., Ges.. Frankfurt-on-Main, Germany. International Convention date, April 17, 1923.

These compounds are obtained by treating 3-oxy-4-aminobenzene-1-arsinic acid or its homologues or analogues, which may be dissolved in sodium acetate solution, with phosgene gas.

214,629. DYES. Soc. of Chemical Industry in Basle, Switzerland. International Convention date, April 19, 1923.

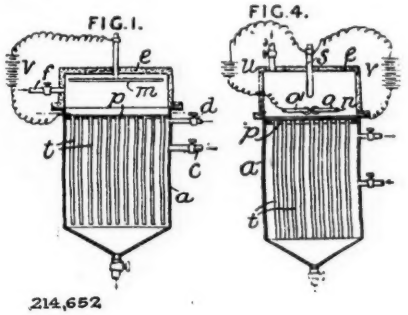
Dyestuffs obtained by coupling the nitrated diazo compound of 1-amino-2-oxynaphthalene-4-sulphonic acid with a naphthol, are treated with reducing agents such as alkali and alkaline earth sulphides, sulphydrates, or polysulphides, and ferrous hydroxide or carbonate. The products are more soluble in calcareous water than the parent dyestuffs, and give grey to black shades on wool when chromed. Examples are given.

214,649. DYEING. Chemische Fabrik Griesheim-Elektron, Frankfurt-on-Main, Germany. International Convention date, April 17, 1923. Addition to 203,032.

Specification 203,032 (see THE CHEMICAL AGE, Vol. IX, p. 376) describes the production of black shades on the fibre from arylazo-1-naphthylamines and arylides of 2 : 3-oxynaphthoic acid. In this invention, the solubility of the products is increased by using non-sulphonated arylazo-1-naphthylamines having in the aryl residue a side chain containing a basic group, *e.g.*, $-CH_2.NH_2$, $-CH_2.NR_1\ R_2$, $-O.CH_2$, $NR_1\ R_2$, $-O.CH_2.CH_2.NR_1\ R_2$, where R_1 and R_2 are alkyl groups. Cotton may be impregnated with 2 : 3-oxynaphthoic β-naphthalide, and developed with a diazo solution obtained from the aminoazo compound from diazotized 4-aminobenzyl-dimethylamine and 1-naphthylamine.

214,652. ELECTRICAL TREATMENT OF REACTING GASES. E. Slatineau, Oberhofen, near Thoune, Switzerland. International Convention date, April 19, 1923.

A reacting gas is subjected to the action of cathode rays between two electrodes, and is also passed through tubes



which form part of an electrode. A horizontal plate *p* carries depending tubes *t* coated externally with platinum, palladium, rhodium, or nickel black, and immersed in a liquid which is to react with the gas. The plate *p* and a parallel plate *m* form the two electrodes, which are connected to a battery *v*, and gas is admitted between the plates by a pipe *f*. The gas passes downwards through the tubes, and upwards through the liquid to the outlet *d*. In a modified construction, a series of vertical rod electrodes *s* are used, and another series of rectangularly arranged electrodes *n*, *o*, *o'* below them. A high-tension battery is connected to the plate *p* as before, and a low tension battery to the electrodes *n*, *o*, *o'*. If the reacting substances are both gases, an inverted construction of the apparatus is used.

214,657. OBTAINING ZINC BY ELECTROLYSIS. Electrolytic Zinc Co. of Australasia, Ltd., 360, Collins Street, Melbourne. (Assignees of H. W. Gepp, 360, Collins Street, Melbourne.) International Convention date, April 21, 1923.

In electrolysing zinc sulphate solution, cathodes of aluminium containing 5–15 per cent. of silicon are used, with lead anodes. Cathodes containing 10 per cent. of silicon are preferred, and may be in the form of thin sheets.

214,662. TUNGSTEN OXIDES. General Electric Co., Ltd., Magnet House, Kingsway, London. (Assignees of A. Just, Budapest.) International Convention date, April 21, 1923.

Tungstic acid is dissolved in ammonia and precipitated with hydrochloric acid at boiling point. The oxide is dried at 120°–150° C. and formed into bars which are heated to dark redness in porcelain tubes in a current of air. The bars are then fused in an oxyhydrogen flame or in an electric arc between tungsten electrodes, cooled, and reduced in hydrogen at 800°–900° C.

LATEST NOTIFICATIONS.

217,546. Process of recovering nitric acid from weak nitric liquors. Deutsche Celluloid Fabrik. June 15, 1923.

217,554. Process of evolving hydrocarbon from fuel. Wisner, C. B. June 11, 1923.

217,570. Manufacture of sulphur-containing casting-compounds. Mandowsky, E. June 13, 1923.

217,578. Centrifugal Pumps. Nash Engineering Co. June 15, 1923.

217,595. Manufacture of resins. Mehta, V. P. June 12, 1923.

217,598. Treatment of natural alkaline salts of secondary and tertiary origin. Cosmic Arts, Inc. June 12, 1923.

Specifications Accepted with Date of Application

201,918. Zinc-bearing ores and metallurgical products, Treatment of. Electrolytic Zinc Co. of Australasia, Ltd. August 1, 1922.

202,299. Zinc fron zinc-bearing ores and metallurgical products, Electrolytic recovery of. Electrolytic Zinc Co. of Australasia, Ltd. August 8, 1922.

204,718. Carbonisation of solid fuel, Process and apparatus for. J. Rude. October 2, 1922.

208,722. Perylene, Process for the manufacture of. Compagnie Nationale de Matières Colorantes et de Produits Chimiques. December 21, 1922.

216,918. Hydrocarbons, particularly lighter petroleum fractions, Purification of. H. D. Demoulins and F. H. Garner. February 7, 1923.

216,922. Hydrocarbon oil vapours, Treatment of—and apparatus therefor. F. Lamplough. March 1, 1923.

216,949. Lignone derivatives, Manufacture and applications of. C. F. Cross and A. Englestad. March 9, 1923.

216,971. Azo dyes, Manufacture of. W. Carpmael. (*Farbenfabriken vorm. F. Bayer & Co.*) March 21, 1923.

216,982. Phosphoric derivatives of inositol, Process for the production of. G. Bruni. March 28, 1923.

217,041. Fuels, Distillation of. Fuel Recovery Syndicate, Ltd., and N. J. Bowater. June 5, 1923.

217,065. Centrifugal Separators. C. R. Schueler. July 4, 1923.

Applications for Patents

Baddiley, J. British Dyestuffs Corporation, Ltd., and Hill, J. Production of greenish-yellow shades on acetyl silk. 14,956. June 20.

Cowles, A. H. Process for producing and utilising alkalis and alumina. 14,763. June 18.

Forcart, O. Bally-, and Haco-Ges Akt.-Ges. Bern. Production of albumen dyestuff products, etc. 15,031. June 21. (November 30, 1923.)

Forst, P. von der. Recovery of ammonia and ammonium compounds from gases. 14,777. June 18.

Hauschka, R. Manufacture of synthetic lanolin. 14,480. June 16.

Heyl, G. E. Obtaining volatile products from mineral deposits in situ. 14,511. June 16.

Heyl, G. E. Treatment of sulphur-containing oils. 14,924. June 20.

Holloway, J. Centrifugal separators. 14,693. June 18.

Imray, O. Y., and Soc. of Chemical Industry in Basle. Manufacture of dyestuffs. 14,768. June 18.

Mailhe, A. Production of petroleum from vegetable, etc., oils and glycerides. 14,743. June 18. (France, June 28, 1923.)

Norsk Hydro-Elektrisk Kvælstofaktieselskab. Process for production of catalysts for synthesis of ammonia. 15,045. June 21. (Norway, July 14, 1923.)

Scherieble, O. Manufacture of soap. 14,669. June 17.

Schindelmeiser, J. Production of thymol and its isomers and homologues. 15,033. June 21.

Terwilliger, C. O. Synthetic resins. 14,652. June 17. (United States, June 29, 1923.)

Terwilliger, C. O. Synthetic resins. 14,653. June 17. (United States, July 5, 1923.)

Tully Gas Plant for Belleville.

BELLEVILLE (Ontario) City Council has decided, after special investigations, to accept the Tully gas plant for the city as from June 1. The investigating committee found the plant able to produce 45,000 cubic ft. of 450 B.Th.U. gas per ton of coal, and heat tests carried out by the Government since the system was installed have ranged from 458 to 484 B.Th.U.

Dismissal of Patent Appeal

THE appeal of the British Oxygen Co., Ltd., from the judgment of Mr. Justice Tomlin, who dismissed their action against the Maine Lighting Co., of Newcastle, for alleged infringement of a patent for controlling the oxygen in metal cutting blowpipes by means of a lever in opposition to a spring tending to keep the valve open, was dismissed by the Court of Appeal, consisting of the Master of the Rolls and Lords Justices Warrington and Sargant on Monday.

The Master of the Rolls stated that there were two claims in plaintiffs' specification, but only one was in question here, and the Court had to decide whether there was sufficient subject matter in respect of that to support the patent. During the trial infringement was admitted, but the validity of the patent was denied, and his Lordship decided against validity on the ground of want of subject matter. He found that validity and utility were established but that there was not sufficient inventive element to support the patent. Mr. Justice Tomlin was right in saying that this was a case in which they had first of all an adjustment of the valve by lever, and then a fine adjustment, by means of a screw, which regulated the limits of control to be generally exercised by the lever. The Master of the Rolls added that it was impossible to accept the view that there really was any inventive step in a common mechanical device placed in the lever in a manner which was common and had been known to all for many years. The appeal would therefore be dismissed with costs.

Lords Justices Warrington and Sargant assented.

Turkey and Pharmaceutical Products

NEW regulations which came into force on April 21 governing the importation into and sale in Turkey of pharmaceutical and druggists' specialities, serums, and vaccines provide that importers and manufacturers' agents who, under the regulations formerly in force, have been granted permission by the Commissariat of Health or by the former Direction-General of Health to import and sell their products, must within three months of April 21 forward three copies of their licence, duly legalised, to the Commissariat of Health at Angora. Those importers and manufacturers' agents who have not been granted such a licence must, within three months from April 21, have the original formulæ—i.e., formulæ specifying the composition of each speciality, without indicating the quantities and the proportion of each ingredient—of the articles to be imported certified by the nearest Turkish Consul or by the Consul of a country charged with the protection of Turkish interests. They must also forward five samples of these articles, with an analysis fee of 505 piastres, to the Commissariat of Health at Angora or the Direction of Social Insurance at Constantinople. The products of importers and manufacturers' agents who have not complied with the above formalities within the period specified will not be allowed to be imported or sold.

Ammonium Perchlorate Claim Concluded

ON Monday the hearing of the five claims in respect of alleged inventions for an improved process for the manufacture of ammonium perchlorate was concluded before the Royal Commission on Awards to Inventors, and judgment was reserved. Owing to the fact that a Swedish secret process was involved, the hearing was conducted *in camera*. The Commmission was presided over by Mr. Justice Tomlin, and consisted of Mr. R. F. Norton, K.C. and Mr. A. Chaston Chapman. Among those who gave evidence in the case were Sir William Pope, and Mr. Carlson, who was associated with the original process which the claimants alleged they had improved. The award of the Commission will be announced shortly.

Sodium Fluoride as a Pulp Preservative

IT has been found by the U.S. Forest Products Laboratory that sodium fluoride is an effective preservative for groundwood pulp. Commercial tests have shown that the growth of fungi and models can be effectively retarded with as little as 16 pounds of sodium fluoride to the ton of pulp at a cost lower than that of sorting good from infected pulp alone, not to mention the actual cost of the decayed pulp.

London Chemical Market

The following notes on the London Chemical Market are specially supplied to THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd., and may be accepted as representing those firms' independent and impartial opinions.*

London, June 26, 1924.

THE volume of business has shown a slight improvement during the last week. There has been more inquiry and the tone is better. A decided improvement seems to be likely after the end of the half-year stocktaking. Prices on the whole are firm and, generally speaking, show an upward tendency.

There has been rather more export inquiry, particularly for the Far East.

General Chemicals

ACETONE.—The spot situation is very firm, but limited quantities have been offered at rather lower prices to arrive. These cheaper offers seem to be due to the realisations of earlier purchases, but makers are holding firmly to their price. The market to-day is about £98 ton.

ACID ACETIC is rather weaker in price. Pure 80 per cent. is valued at £46 per ton and technical is slightly lower.

ACID CITRIC is very firm and with a continuance of the fine weather an advance in price is likely. The present value is about 1s. 6½d. per lb., less 5%.

ACID FORMIC is quiet and uninteresting. Price nominally £60 per ton for the 85% grade.

ACID LACTIC is only in moderate request. Price seems inclined to sag; to-day's quotation is £44 per ton for 50% by weight.

ACID OXALIC.—The price seems to have touched bottom and is to-day 4½d. to 4¾d. per lb., according to quantity and packages.

ACID TARTARIC is decidedly firmer in price. Demand is springing up and an advance is looked for. The market to-day is 1s. 1d. per lb., less 5%.

ALUM is still in fair demand and unchanged at about 10 guineas per ton.

ARSENIC is very slow. Market prices seem likely to go lower, price to-day being £47 to £48 per ton.

BARIUM CHLORIDE, which is only in fair demand, is obtainable at about £13 10s. per ton.

BLEACHING POWDER.—Most buyers are under contract and the business passing is of small dimensions. Price unchanged.

COPPER SULPHATE.—Unchanged.

CREAM OF TARTAR is in fair demand, the value to-day being £83 to £84 per ton, less 2½% discount.

CALCIUM CHLORIDE.—The demand is improving; the present price of about £5 per ton seems likely to advance.

EPSOM SALTS.—Foreign supplies are getting dearer; parcels of technical quality can still be picked up at £4 10s. to £5 per ton.

FORMALDEHYDE.—The fall in price has been arrested, the market to-day standing at £55 to £56 per ton.

LEAD ACETATE is in good demand. English makers quote £48 per ton for white, with foreign offering at several pounds per ton less. The brown quality is firm at £44 per ton.

POTASSIUM CARBONATE is uninteresting.

POTASSIUM PERMANGANATE is fairly active, but the price tends in buyers' favour. The market is weak at 8d. per lb.

POTASSIUM PRUSSIATE is slow of sale; price nominally 9d. per lb.

SODA ACETATE is weaker and quoted at £23 15s. to £24 per ton.

SODA BICHROMATE is unchanged at English Convention prices.

SODA HYPOSULPHITE.—Unchanged.

SODA NITRITE is in good demand and stocks are limited. Price is £27 10s. per ton, ex store.

SODA PRUSSIATE.—There is not much demand; price nominally 4½d. per lb.

SODA SULPHIDE.—Unchanged.

ZINC SULPHATE continues to sag in price at about £13 10s. to £13 15s. per ton.

Coal Tar Intermediates

The trade in this market during the past week has continued moderately active, without any change in prices to report.

ALPHA NAPHTHOL has been inquired for on home account.

ALPHA NAPHTHYLAMINE is of interest for export, without change in value.

ANILINE OIL AND SALT are in moderate request.

BENZIDINE BASE.—The usual home trade business has been received.

BETA NAPHTHOL is moderately active in the home market.

DIMETHYLANILINE is of interest chiefly on export account.

"H" ACID has been moving in moderate quantities.

NITRO BENZOL.—A fair business is passing, without change in value.

PARANITRANILINE is quiet, the price being unchanged.

"R" SALT is unchanged.

RESORCIN.—A fair home trade business has been placed.

XYLIDINE is in small demand.

Coal Tar Products

The market in coal tar products is very quiet, and there is little fresh business passing.

90% BENZOL is steady at 1s. 6½d. to 1s. 7d. per gallon on rails.

PURE BENZOL is quiet at 1s. 10½d. to 1s. 11d. per gallon on rails.

CREOSOTE OIL is weak, and values continue to fall. The price to-day is about 6¾d. per gallon on rails in the North for prompt delivery, while the value in London is about 7¼d. per gallon.

CRESYLIC ACID is steady at 2s. 1d. per gallon on rails for the Pale quality 97/99%, while the Dark quality 95/97% is worth about 1s. 9d. per gallon on rails.

SOLVENT NAPHTHA is slightly weaker, and is worth about 1s. 2d. per gallon on rails.

HEAVY NAPHTHA is also worth about 1s. 2d. per gallon.

NAPHTHALENES are quiet, the low qualities being worth about £5 10s. to £6 per ton, the 74/76 melting point about £6 10s. to £7 per ton, and 76/78 melting point £7 to £7 10s. per ton.

PITCH is dull and very few transactions are reported for either prompt or forward delivery.

Sulphate of Ammonia

SULPHATE OF AMMONIA.—This is in satisfactory demand for export, and prices are unchanged.

Tariff Changes

BRITISH INDIA.—The removal of the import duty on sulphur has been recommended by the Indian Tariff Board.

GERMANY.—Considerable additions have been made to the import force list, including the following:—Chemically prepared foodstuffs; natural sulphates of barytes (heavy spar), and of strontium (celestine) even powdered or ground; soap works lye; bromine; iodine; nitric acid, including red fuming nitric acid; acetic acid, even in crystals (glacial); acetic anhydride; artificial spring salts; carbonate of ammonia; phosphate of potassium; nitrate of ammonia, not in shells or capsules; nitrate of lead; potassium nitrate; barium nitrate; acetate and pyrolignite of lime; iron mordant; sodium acetate; Schweinfurt green; acetates of ammonia, chrome and copper and other acetates, not elsewhere specified (in the Tariff); acetone oil; artificial carbonate of strontium; chloride of strontium; strontium hydroxide and peroxide; nitrites not elsewhere mentioned (in the Tariff), *e.g.*, nitrites of ammonia, potash and soda; ethyl ether and other ethers of all kinds, plain or compound; oil extracted from pressed grapes; fusel oil, also amylic, butylic and propylic alcohol; methyl alcohol, crude; acetone, crude; chloroform; chloral hydrate; essences, extracts, tinctures, waters and the like, not perfumed, for industrial or medicinal use (not including dyeing and tanning extracts).

IRISH FREE STATE.—Under the Budget proposals the Customs duties on the following chemicals ceased as from May 1, 1924:—Chloral hydrate, chloroform, collodion, ether (acetic, butyric and sulphuric), ethyl iodide, ethyl bromide and ethyl chloride.

Weekly Prices of British Chemical Products

The prices and comments given below respecting British chemical products are based on direct information supplied by the British manufacturers concerned. Unless otherwise qualified, the figures quoted apply to fair quantities, net and naked at sellers' works.

General Heavy Chemicals

All grades of Boric Acid have been reduced by £3 per ton as from June 11. Borax prices remain unchanged. Prices remain generally steady.

Acid Acetic 40% Tech.—£23 10s. per ton.
Acid Boric, Commercial.—Crystal, £45 per ton. Powder, £47 per ton
Acid Hydrochloric.—3s. 6d. to 6s. per carboy d/d., according to purity, strength and locality.
Acid Nitric 80° Tw.—£21 10s. to £27 per ton, makers' works, according to district and quality.
Acid Sulphuric.—Average National prices f.o.r. makers' works, with slight variations up and down owing to local considerations : 140° Tw., Crude Acid, 65s. per ton. 168° Tw., Arsenical, £5 10s. per ton. 168° Tw., Non-arsenical, £6 15s. per ton.
Ammonia Alkali.—£6 15s. per ton f.o.r. Special terms for contracts.
Bleaching Powder.—Spot, £11 d/d. ; Contract, £10 d/d. 4 ton lots.
Bisulphite of Lime.—£7 per ton, packages extra.
Borax, Commercial.—Crystal, £25 per ton. Powder, £26 per ton. (Packed in 2-cwt. bags, carriage paid any station in Great Britain.)
Calcium Chloride.—£5 17s. 6d. per ton d/d.
Methylated Spirit 64 O.P.—Industrial, 3s. 1d. to 3s. 5d. per gall. Mineralised, 4s. 2d. to 4s. 6d. per gall., in each case according to quantity.
Potash Caustic.—£30 to £33 per ton.
Potassium Bichromate.—5½d. per lb.
Potassium Chlorate.—3d. to 4d. per lb.
Salammoniac.—£32 per ton d/d.
Salt Cake.—£3 10s. per ton d/d.
Soda Caustic, Solid.—Spot lots delivered, £16 7s. 6d. to £19 7s. 6d. per ton, according to strength ; 20s. less for contracts.
Soda Crystals.—£5 5s. to £5 10s. per ton ex railway depots or ports.
Sodium Acetate 97/98%.—£24 per ton.
Sodium Bicarbonate.—£10 10s. per ton carr. paid.
Sodium Bichromate.—4½d. per lb.
Sodium Bisulphite Powder 60/62%.—£18 to £19 per ton according to quantity, f.o.b., 1-cwt. iron drums included.
Sodium Chlorate.—3d. per lb.
Sodium Nitrate refined 96%.—£13 5s. to £13 10s. per ton ex Liverpool. Nominal.
Sodium Nitrite 100% basis.—£27 per ton d/d.
Sodium Sulphide conc. 60/65.—About £14 10s. per ton d/d.
Sodium Sulphide Crystals.—£9 per ton d/d.
Sodium Sulphite, Pea Crystals.—£15 per ton f.o.r. London, 1-cwt. kegs included.

Coal Tar Products

Prices in this section remain unaltered.

Acid Carbolic Crystals.—6½d. to 6¾d. per lb. Better inquiry. Crude 60's, 1s. 9d. to 1s. 10d. per gall. Market flat, only odd lots being offered.
Acid Cresylic 97/99.—2s. 1d. to 2s. 3d. per gall. Demand still good. Market firm. Pale 95%, 1s. 10d. to 1s. 11d. per gall. Steady demand. Dark, 1s. 8d. to 1s. 11d. per gall. Steady business.
Anthracene Paste 40%.—4d. per unit per cwt. Nominal price No business.
Anthacene Oil, Strained.—9½d. per gall. Very quiet. Unstrained. 8½d. to 9d. per gall.
Benzol.—Crude 65's.—10½d. to 1s. per gall. ex works in tank wagons. Standard Motor, 1s. 4½d. to 1s. 6d. per gall. ex works in tank wagons. Pure, 1s. 8½d. to 1s. 10d. per gall. ex works in tank wagons.
Toluol.—90%, 1s. 5½d. per gall. Pure, 1s. 10d. to 2s. per gall.
Xylol Commercial.—2s. 3d. per gall. Pure, 3s. 3d. per gall.
Creosote.—Cresylic 20/24%, 9d. to 9½d. per gall. Few inquiries. Middle Oil, Heavy and Standard Specification, 6¾d. to 9d. per gall. according to grade and district. Market very quiet.
Naphtha.—Crude, 8d. to 9d. per gall. Solvent 90/160, 1s. 4d. to 1s. 5d. per gall. Market steady. Solvent 90/190, 1s. 1d. to 1s. 4d. per gall. Fair business passing.
Naphthalene Crude.—Drained Creosote Salts, £6 to £6 10s. Demand falling off. Whizzed or hot pressed, £9 to £12 per ton. More inquiry.
Naphthalene.—Crystals and Flaked, £16 to £17 per ton.
Pitch.—Medium soft, 52s. 6d. to 57s. 6d. per ton. No export business at present. Plenty of inquiries for next season.
Pyridine.—90/160, 21s. to 22s. per gall. Market less firm. Heavy, 12s. to 12s. 6d. Market steady.

Intermediates and Dyes

Business in dyestuffs has been fairly good and has shown a little further improvement during the past week. Prices remain unaltered.

In the following list of Intermediates delivered prices include packages except where otherwise stated.

Acetic Anhydride 95%.—1s. 6d. per lb.
Acid H.—4s. 3d. per lb. 100% basis d/d.
Acid Naphthionic.—2s. 4d. per lb. 100% basis d/d.
Acid Neville and Winther.—5s. 8d. per lb. 100% basis d/d.
Acid Salicylic, technical.—1s. 1½d. to 1s. 2d. per lb. Better demand at reduced prices.
Acid Sulphanilic.—9½d. per lb. 100% basis d/d.
Aluminium Chloride, anhydrous.—1s. per lb. d/d.
Aniline Oil.—7¾d. to 8½d. per lb. naked at works.
Aniline Salts.—7¾d. to 9d. per lb. naked at works.
Antimony Pentachloride.—1s. per lb. d/d.
Benzidine Base.—4s. 6d. per lb. 100% basis d/d.
Benzyl Chloride 95%.—1s. 3d. per lb.
p-Chlorphenol.—4s. 3d. per lb. d/d.
p-Chloraniline.—3s. per lb. 100% basis.
o-Cresol 19/31° C.—4½d. per lb. Demand steady.
m-Cresol 98/100%.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
p-Cresol 32/34° C.—2s. 1d. to 2s. 3d. per lb. Demand moderate.
Dichloraniline.—3s. per lb.
Dichloraniline S. Acid.—2s. 6d. per lb. 100% basis.
p-Dichlorbenzol.—£75 per ton.
Diethylaniline.—4s. 9d. per lb. d/d., packages extra, returnable.
Dimethyaniline.—2s. 4d. per lb. d/d. Drums extra.
Dinitrobenzene.—9d. per lb. naked at works.
Dinitrochlorbenzol.—£84 10s. per ton d/d.
Dinitrotoluene.—48/50° C. 8d. to 9d. per lb. naked at works. 66/68° C. 1s. 2d. per lb. naked at works.
Diphenylamine.—3s. per lb. d/d.
Monochlorbenzol.—£63 per ton.
B-Naphthol.—1s. 1d. per lb. d/d.
a-Naphthylamine.—1s. 4½d. per lb. d/d.
B-Naphthylamine.—4s. per lb. d/d.
m-Nitraniline.—5s. 3d. per lb. d/d.
p-Nitraniline.—2s. 4d. per lb. d/d.
Nitrobenzene.—5½d. to 5½d. per lb. naked at works.
o-Nitrochlorbenzol.—2s. per lb. 100% basis d/d.
Nitronapthalene.—11¾d. per lb. d/d.
p-Nitrophenol.—1s. 9d. per lb. 100 % basis d/d.
p-Nitro-*o*-amido-phenol.—4s. 6d. per lb. 100% basis.
m-Phenylene Diamine.—4s. 2d. per lb. d/d.
p-Phenylene Diamine.—10s. 3d. per lb. 100% basis d/d.
R. Salt.—2s. 6d. per lb. 100% basis d/d.
Sodium Naphthionate.—2s. 5d. per lb. 100% basis d/d.
o-Toluidine.—8½d. per lb.
p-Toluidine.—3s. 6d. per lb. naked at works.
m-Toluylene Diamine.—4s. 6d. per lb. d/d.

Wood Distillation Products

All prices keep fairly stable, but there is room for improvement in business.

Acetate of Lime.—Brown, £14 10s. per ton d/d. Demand active. Grey, £19 to £20 per ton. Fair demand. Liquor, 9d. per gall. 32° Tw.
Charcoal.—£7 5s. to £9 per ton, according to grade and locality. Demand below normal.
Iron Liquor.—1s. 7d. per gall. 32° Tw. 1s. 2d. per gall. 24° Tw.
Red Liquor.—10d. to 1s. per gall. 14/15° Tw.
Wood Creosote.—2s. 7d. per gall. Unrefined.
Wood Naphtha, Miscible.—5s. per gall. 60% O.P. Market dull. Solvent, 5s. 6d. per gall. 40% O.P. Fairly good demand.
Wood Tar.—£5 per ton.
Brown Sugar of Lead.—£49 per ton.

Rubber Chemicals

Antimony Sulphide.—Golden, 5¾d. to 1s. 4d. per lb., according to quality. Crimson, 1s. 3d. to 1s. 6d. per lb., according to quality.
Arsenic Sulphide, Yellow.—1s. 11d. per lb.
Barytes.—£3 10s. to £16 15s. per ton, according to quality.
Cadmium Sulphide.—3s. 9d. per lb.
Carbon Bisulphide.—£24 to £26 per ton according to quantity.
Carbon Black.—6½d. to 6¾d. per lb. Market firmer.
Carbon Tetrachloride.—£55 per ton, drums free.
Chromium Oxide, Green.—1s. 3d. per lb.
Indiarubber Substitutes, White and Dark.—4¾d. to 6½d. per lb. Demand very brisk. Prices likely to remain steady owing to firmness of rapeseed oils.
Lamp Black.—45s. per cwt., barrels free. Dearer.
Lead Hyposulphite.—7½d. per lb.
Lithopone, 30%.—£22 10s. per ton.
Mineral Rubber " Rubpron."—£15 10s. per ton f.o.r. London.
Sulphur.—£10 to £12 per ton, according to quality.
Sulphur Chloride.—3d. per lb., carboys extra.
Thiocarbanilide.—2s. 9d. per lb.
Vermilion, Pale or Deep.—4s. 10d. per lb. Easier.
Zinc Sulphide.—7½d. to 1s. 8d. per lb., according to quality.

Pharmaceutical and Photographic Chemicals

The demand is steady for small quantities required for home consumption, but export inquiry for larger bulk is wanting.

Acid, Acetic 80% B.P.—£47 per ton.
Acid, Acetyl Salicylic.—3s. 3d. to 3s. 5d. per lb. Market rather weak, but fair demand.
Acid, Benzoic B.P.—3s. 9d. per lb. Larger supplies available.
Acid, Boric B.P.—Crystal £51 per ton, Powder £55 per ton. Carriage paid any station in Great Britain. Prices reduced by £3 per ton.
Acid, Camphoric.—19s. to 21s. per lb.
Acid, Citric.—1s. 6½d. per lb., less 5% for ton lots. Market extremely firm. Upward tendency.
Acid, Gallic.—3s. per lb. for pure crystal. Market very steady.
Acid, Pyrogallic, Crystals.—7s. per lb. for 1 cwt. lots. Market firm; increasing demand.
Acid, Salicylic.—Prices quoted from 2s. per lb. down to 1s. 8d. for ton lots. Market still weak.
Acid, Tannic B.P.—3s. per lb. Market quiet.
Acid, Tartaric.—1s. 1½d. to 1s. 2d. per lb., less 5%. Better tone, but not yet very active. Cheap offers of second-hand parcels of foreign acid. Higher prices expected in view of firmness of raw materials.
Amidol.—9s. per lb. d/d.
Acetanilide.—2s. 3d. per lb. for quantity. Demand slow. Prices shaded to secure large orders.
Amidopyrin.—13s. 3d. per lb. Neglected. Stocks low.
Ammonium Benzoate.—3s. 3d. to 3s. 6d. per lb. according to quantity.
Ammonium Carbonate B.P.—£37 per ton.
Atropine Sulphate.—12s. 6d. per oz. for English make.
Barbitone.—15s. per lb. Quiet market.
Benzonaphthol.—5s. 6d. per lb. Small inquiry.
Bismuth Salts.—A steady market. Prices according to quantity.
Bismuth Carbonate.—12s. 9d. to 14s. 9d. per lb.
Bismuth Citrate.—11s. 4d. to 13s. 4d. per lb.
Bismuth Salicylate.—10s. 2d. to 12s. 2d. per lb.
Bismuth Subnitrate.—10s. 9d. to 12s. 9d. per lb.
Borax B.P.—Crystal £29, Powder £30 per ton. Carriage paid any station in Great Britain.
Bromides.—Fluctuating market. Continental prices decidedly firmer. Potassium, 11d. per lb.; sodium, 1s. per lb.; ammonium, 1s. 1d. per lb.
Calcium Lactate.—Demand active. Good English make can be had from 1s. 7d. to 2s. 6d. per lb.
Chloral Hydrate.—3s. 7d. to 3s. 9d. per lb., duty paid.
Chloroform.—2s. per lb. for cwt. lots. Market more active. Makers busy.
Creosote Carbonate.—6s. 6d. per lb. Little demand.
Formaldehyde.—£57 per ton, ex works. English make.
Glycerophosphates.—Fair business passing. Calcium, soluble and citrate free, 7s. per lb.; iron, 8s. 9d. per lb.; magnesium, 9s. per lb.; potassium, 50%, 3s. 6d. per lb.; sodium, 50%, 2s. 6d. per lb.
Guaiacol Carbonate.—11s. per lb. for cwt. lots. Slightly cheaper.
Hexamine.—3s. 6d. per lb. for English make. Market quiet and steady.
Homatropine Hydrobromide.—30s. per oz.
Hydrastine Hydrochloride.—English make offered at 120s. per oz.
Hydroquinone.—4s. 3d. per lb. in cwt. lots. Foreign make.
Hypophosphites.—Calcium, 3s. 6d. per lb. for 28 lb. lots; potassium, 4s. 1d. per lb.; sodium, 4s. per lb.
Iron Ammonium Citrate B.P.—2s. 1d. to 2s. 5d. per lb., according to quantity. Advanced by 2d. per lb.
Magnesium Carbonate.—Light Commercial, £36 per ton net.
Magnesium Oxide.—Light Commercial, £75 per ton, less 2½%; Heavy Commercial, £26 per ton, less 2½%; Heavy Pure, 1s. 6d. to 2s. per lb., according to quantity. Steady market.
Menthol.—A.B.R. recrystallised B.P., 55s. per lb. Weaker. Synthetic, 26s. to 35s. per lb., according to quantity. English make. Steady demand.
Mercurials.—Market firm. Red oxide, 5s. 3d. to 5s. 4d. per lb.; Corrosive sublimate, 3s. 6d. to 3s. 7d. per lb.; white precipitate, 4s. 7d. to 4s. 8d. per lb.; Calomel, 3s. 11d. to 4s. per lb.
Methyl Salicylate.—2s. to 2s. 3d. per lb. for carboys. Not much demand.
Metol.—11s. per lb. British make.
Paraformaldehyde.—3s. per lb.
Paraldehyde.—1s. 4½d. to 1s. 6d. per lb. in free bottles and cases. Better demand.
Phenacetin.—6s. per lb. Ample stocks available.
Phenazone.—7s. per lb. for cwt. lots. Quiet.
Phenolphthalein.—6s. 6d. per lb. Easier, with supplies more plentiful.
Potassium Bitartrate 99/100% (Cream of Tartar).—88s. per cwt., less 2½% for ton lots. Firm market. Prices have upward tendency.
Potassium Citrate.—1s. 10d. to 2s. 2d. per lb. Dearer.
Potassium Iodide.—16s. 8d. to 17s. 5d. per lb., according to quantity. Demand continues.
Potassium Metabisulphite.—7½d. per lb., 1-cwt. kegs included.
Potassium Permanganate.—B.P. crystals, 8¾d. to 9d. per lb., carriage paid; commercial, 8d. to 8¼d. per lb., carriage paid.
Quinine Sulphate.—2s. 3d. to 2s. 4d. per oz., in 100 oz. tins. Steady market.
Resorcin.—5s. 6d. per lb.
Saccharin.—63s. per lb. in 50-lb. lots.
Salol.—3s. 6d. to 3s. 11d. per lb. Easier in sympathy with other salicylates.
Silver Proteinate.—9s. 6d. per lb.
Sodium Benzoate, B.P.—2s. 9d. per lb. In steady demand for good qualities.
Sodium Citrate, B.P.C., 1923.—1s. 11d. to 2s. 2d. per lb., according to quantity. Firmer in common with other citrates.
Sodium Hypophosphite, Photographic.—£13 to £15 per ton, according to quantity, d/d. consignee's station in 1-cwt. kegs.
Sodium Metabisulphite Crystals.—37s. 6d. to 60s. per cwt., net cash, according to quantity.
Sodium Nitroprusside.—16s. per lb. Less for quantity.
Sodium Potassium Tartrate (Rochelle Salt).—77s. 6d. to 81s. 6d. per cwt., according to quantity. Market quiet.
Sodium Salicylate.—Powder, 2s. 2d. to 2s. 6d. per lb. Crystal, 2s. 5d. to 2s. 8d. per lb. Flake, 2s. 9d. to 2s. 10d. per lb.
Sodium Sulphide, pure recrystallised.—10d. to 1s. 2d. per lb., according to quantity.
Sodium Sulphite, anhydrous, £27 10s. to £28 10s. per ton, according to quantity, 1 cwt. kegs included. In large casks £1 per ton less.
Thymol.—15s. to 15s. 6d. per lb. for good white crystal from ajowan seed. Very firm and scarce.

Perfumery Chemicals

Acetophenone.—12s. 6d. per lb.
Aubepine.—14s. 6d. per lb.
Amyl Acetate.—2s. 9d. per lb.
Amyl Butyrate.—6s. 9d. per lb. Cheaper.
Amyl Salicylate.—3s. 3d. per lb.
Anethol (M.P. 21/22° C.).—4s. 6d. per lb.
Benzyl Acetate from Chlorine-free Benzyl Alcohol.—2s. 10½d. per lb. Cheaper.
Benzyl Alcohol free from Chlorine.—2s. 10½d. per lb.
Benzaldehyde free from Chlorine.—3s. 6d. per lb.
Benzyl Benzoate.—3s. 6d. per lb.
Cinnamic Aldehyde Natural.—15s. 6d. per lb.
Coumarin.—20s. per lb.
Citronellol.—16s. per lb.
Citral.—10s. per lb.
Ethyl Cinnamate.—15s. per lb.
Ethyl Phthalate.—3s. 3d. per lb. Reduced.
Eugenol.—10s. 6d. per lb. Cheaper.
Geraniol (Palmarosa).—35s. per lb.
Geraniol.—11s. to 18s. 6d. per lb.
Heliotropine.—7s. per lb. Advanced.
Iso Eugenol.—15s. 9d. per lb.
Linalol ex Bois de Rose.—26s. per lb. Cheaper.
Linalyl Acetate.—26s. per lb. Cheaper.
Methyl Anthranilate.—9s. 6d. per lb.
Methyl Benzoate.—6s. per lb.
Musk Ambrette.—43s. per lb. Cheaper.
Musk Xylol.—16s. 6d. per lb. Reduced.
Nerolin.—4s. 9d. per lb. Advanced.
Phenyl Ethyl Acetate.—12s. 6d. per lb.
Phenyl Ethyl Alcohol.—16s. per lb.
Rhodinol.—57s. 6d. per lb.
Safrol.—1s. 10d. per lb.
Terpineol.—2s. 4d. per lb. Cheaper.
Vanillin.—25s. 3d. to 26s. 6d. per lb.

Essential Oils

Almond Oil, Foreign S.P.A.—15s. 6d. per lb.
Anise Oil.—2s. 8d. per lb. Cheaper.
Bergamot Oil.—19s. 6d. per lb. Dearer.
Bourbon Geranium Oil.—36s. 6d. per lb. Advanced.
Camphor Oil.—75s. per cwt.
Cananga Oil, Java.—10s. 6d. per lb.
Cinnamon Oil, Leaf.—6½d. per oz.
Cassia Oil, 80/85%.—8s. 9d. per lb. Cheaper.
Citronella Oil.—Java, 85/90%, 6s. per lb. Again dearer. Ceylon, 3s. 9d. per lb.
Clove Oil.—7s. 3d. per lb. Cheaper.
Eucalyptus Oil, 70/75%.—2s. 2d. per lb.
Lavender Oil.—French 38/40% Esters, 27s. 6d. per lb.
Lemon Oil.—3s. 2d. per lb.
Lemongrass Oil.—3d. per oz.
Orange Oil, Sweet.—13s. 9d. per lb.
Otto of Rose Oil.—Bulgarian, 27s. 6d. per oz. Anatolian, 23s. 6d. per oz.
Palma Rosa Oil.—19s. per lb.
Peppermint Oil.—Wayne County, 20s. 9d. per lb. Cheaper. Japanese, 15s. 6d. per lb. Cheaper.
Petitgrain Oil.—10s. per lb.
Sandal Wood Oil.—Mysore, 26s. 6d. per lb. Australian, 21s. per lb.

Scottish Chemical Market

The following notes on the Scottish Chemical Market are specially supplied to* THE CHEMICAL AGE *by Messrs. Charles Tennant and Co., Ltd., Glasgow, and may be accepted as representing the firm's independent and impartial opinions.

Glasgow, June 26, 1924.

THE past week has been one of the quietest experienced in the heavy chemical market for some time, there being practically no inquiry of any importance.

Home manufacturers' prices are, on the whole, unchanged, but Continental offers are inclined to be lower.

Industrial Chemicals

ACID ACETIC.—Glacial, 98/100%, £60 to £70 per ton; 80% pure, £49 to £50 per ton; 80% technical, £46 to £47 per ton. All packed in casks delivered, c.i.f. U.K. ports, duty free.

ACID BORACIC.—Crystal or granulated, £45 per ton; powdered, £47 per ton, carriage paid U.K. stations, minimum ton lots.

ACID CARBOLIC, ICE CRYSTALS.—In little demand, nominally 6½d. per lb., but could probably be obtained at considerably less.

ACID CITRIC, B.P. CRYSTALS.—Quoted 1s. 6½d. per lb., less 5%. ex store, spot delivery. Offered for early delivery at 1s. 5¾d. per lb., less 5% ex wharf.

ACID FORMIC 85%.—Spot lots quoted £62 5s. per ton, ex store. Offered for forward delivery at about £55 10s. per ton, ex wharf.

ACID HYDROCHLORIC.—In little demand. Price 6s. 6d. per carboy, ex works.

ACID NITRIC 80°.—£23 10s. per ton, ex station, full truck loads.

ACID OXALIC.—Moderate inquiry. Spot lots now quoted 4½d. per lb., ex store. Offered from the Continent at about 4d. per lb., c.i.f. U.K.

ACID SULPHURIC.—144°, £3 12s. 6d. per ton; 168°, £7 per ton, ex works, full truck loads. De-arsenicated quality, 20s. per ton more.

ACID TARTARIC, B.P. CRYSTALS.—Rather better inquiry. Spot lots now quoted 1s. 2½d. per lb. less 5% ex store. Offered for early delivery at about 1s. 2d. per lb., less 5% ex wharf.

ALUMINA SULPHATE, 17/18% IRON FREE.—Quoted £7 15s. per ton, ex store spot delivery. Offered for early delivery at about £7 2s. 6d. per ton, c.i.f. U.K. port.

ALUM, CHROME.—Ammonium chrome alum quoted £19 to £21 per ton according to quality f.o.b. U.K. port. Potash chrome alum on offer at £26 per ton, ex store.

ALUM, POTASH (LUMP).—Offered for early delivery at about £9 per ton, c.i.f. U.K. port. Spot lots quoted £10 5s. per ton, ex store.

AMMONIA ANHYDROUS.—Quoted 1s. 5½d. per lb., ex station, spot delivery. Offered for early delivery from the Continent at slightly less.

AMMONIA CARBONATE.—Lump, £37 per ton; powdered, £39 per ton, packed in 5 cwt. casks, delivered U.K.

AMMONIA LIQUID 880.—Unchanged at 2½d. to 3d. per lb., delivered, according to quantity. Containers extra.

AMMONIA MURIATE.—Grey galvanisers quality unchanged at £30 per ton, ex station. Fine white crystals offered from the Continent at £25 5s. per ton, c.i.f. U.K. port.

AMMONIA SULPHATE.—25$\frac{1}{4}$%, £13 12s. per ton; 25$\frac{3}{4}$% neutral quality, £14 15s. per ton, ex works, prompt delivery.

ARSENIC, WHITE POWDERED.—Quoted £47 10s. per ton, f.o.b. U.K. port for export. Spot lots quoted £53 per ton, ex store, but could probably be obtained for less. Practically no inquiry.

BARIUM CARBONATE 98/100%.—Quoted £11 10s. per ton, c.i.f. U.K. port, prompt shipment from the Continent.

BARIUM CHLORIDE 98/100%.—English material unchanged at about £14 per ton, ex store. Offered from the Continent at about £13 5s. per ton, c.i.f. U.K. port.

BARYTES.—Finest English white quoted £5 5s. per ton, ex works. Continental about £5 per ton, c.i.f. U.K. port.

BLEACHING POWDER.—Spot lots £11 per ton, ex station. Contracts 20s. per ton less.

BORAX.—Granulated, £24 10s. per ton; crystals, £25 per ton; powdered, £26 per ton carriage paid U.K. stations, minimum ton lots.

CALCIUM CHLORIDE.—English material unchanged at £5 12s. 6d. per ton, ex station. Offered from the Continent at about £5 per ton, c.i.f. U.K. port.

COPPERAS, GREEN.—Unchanged at about £2 5s. per ton, f.o.b. U.K. port, in bulk. Quoted £3 5s. to £3 10s. per ton, in casks.

COPPER SULPHATE.—On offer at £23 10s. per ton, f.o.b. U.K. port for export.

FORMALDEHYDE 40%.—In little demand. Quoted £57 per ton, ex wharf, spot delivery. Offered for early shipment at £54 per ton, c.i.f. U.K.

GLAUBER SALTS.—English material unchanged at £4 per ton, ex store or station. Continental on offer at £3 10s. per ton, ex wharf, spot delivery.

LEAD, RED.—Spot material of Continental manufacture unchanged at £37 per ton, ex store.

LEAD, WHITE.—Quoted £43 15s. per ton, ex store, spot delivery.

LEAD, ACETATE.—White crystals quoted £47 per ton, ex store, spot delivery. Offered from the Continent at £46 per ton, ex wharf. Brown about 10s. per ton less.

MAGNESITE, CALCINED.—Moderate inquiry for export. Quoted £8 per ton, ex station, prompt delivery.

MAGNESIUM CHLORIDE.—On offer from the Continent at £3 10s. per ton, c.i.f. U.K. port. Spot lots quoted £3 17s. 6d. per ton, ex store.

MAGNESIUM SULPHATE (EPSOM SALTS).—English material quoted £4 15s. per ton, ex store, spot delivery. B.P. quality on offer at about £6 5s. per ton, ex station.

POTASH CAUSTIC 88/92%.—Unchanged at about £30 per ton, ex store, spot delivery. Offered from the Continent at £29 per ton, c.i.f. U.K. port.

POTASSIUM BICHROMATE.—Unchanged at 5¾d. per lb., delivered.

POTASSIUM CARBONATE 96/98%.—Offered from the Continent at £24 per ton, c.i.f. U.K. port. Spot lots on offer at about £25 10s. per ton, ex store.

POTASSIUM CHLORATE.—In little demand. Quoted 3d. per lb., ex store.

POTASSIUM NITRATE (SALTPETRE).—Moderate inquiry. Spot lots available at £30 per ton, ex store. Offered from the Continent at £27 per ton, c.i.f. U.K. port.

POTASSIUM PERMANGANATE, B.P. CRYSTALS.—Quoted 8½d. per lb., ex store, spot delivery. On offer from the Continent at 7d. per lb., c.i.f. U.K.

POTASSIUM PRUSSIATE (YELLOW).—Moderate inquiry for export. Quoted 8½d. per lb., f.o.b. U.K. port. Spot lots available at about the same figure.

SODA CAUSTIC.—76/77%, £19 7s. 6d. per ton; 70/72%, £17 17s. 6d. per ton; 60/62% broken, £19 2s. 6d. per ton; 98/99% powdered, £22 15s. per ton. All ex station, spot delivery. Contracts 20s. per ton less.

SODIUM ACETATE.—Quoted £24 10s. per ton, ex store, spot delivery. On offer from the Continent at about £22 10s. per ton, c.i.f. U.K.

SODIUM BICARBONATE.—Refined recrystallised quality, £10 10s. per ton, ex quay or station, M.W. quality 30s. per ton less.

SODIUM BICHROMATE.—English makers' prices unchanged at 4½d. per lb., D/d.

SODIUM CARBONATE.—Soda crystals, £5 to £5 5s. per ton, ex quay or station. Alkali, £58%, £8 12s. 3d. per ton, ex quay or station.

SODIUM HYPOSULPHITE.—English material quoted £10 per ton, ex station. Continental now offered at £8 12s. 6d. per ton, c.i.f. U.K. port. Pea crystals of English manufacture quoted £13 15s. per ton, ex station.

SODIUM NITRATE.—95/96% quality quoted £13 10s. per ton, f.o.r. or f.o.b. U.K. port. 96/98%, 7s. 6d. per ton extra.

SODIUM NITRITE, 100%.—Spot lots quoted £27 10s. per ton, ex store.

SODIUM PRUSSIATE (YELLOW).—Unchanged at about 4½d. per lb., ex station or f.o.b. U.K. port.

SODIUM SULPHATE (SALTCAKE).—Price for home consumption, £3 10s. per ton, carriage paid buyers' station, good inquiry for export and price about £3 per ton, f.o.b. U.K. port.

SODIUM SULPHIDE.—60/62%, solid of English manufacture, £14 15s. per ton, ex station; broken, £1 per ton more; flake, £2 per ton more. 60/62% solid, offered from the Continent at £12 5s. per ton, c.i.f. U.K. port; broken, £1 per ton more. 31/34% crystals of English manufacture, £9 2s. 6d. per ton, ex station. 30/32% crystals of Continental manufacture quoted £8 10s. per ton, c.i.f. U.K. port.

SULPHUR.—Flowers, £10 per ton; roll, £9 per ton; rock, £9 per ton; ground, £8 per ton. Prices nominal.

TIN CRYSTALS.—Moderate inquiry for export. Quoted 1s. 3½d. per lb., f.o.b. U.K. port.

ZINC CHLORIDE, 96/98%.—Now quoted £27 5s. per ton, f.o.b. U.K. port.

ZINC SULPHATE.—English material unchanged at £13 10s. per ton, ex station. Offered from the Continent at about £11 2s. 6d. per ton, c.i.f. U.K. port.

NOTE.—The above prices are for bulk business and are not to be taken as applicable to small parcels.

Coal Tar Intermediates and Wood Distillation Products

ALPHA NAPHTHYLAMINE.—Good home inquiries. Price firm at 1s. 4½d. per lb.

ALPHA NAPHTHOL.—Export inquiries. Price, 2s. 5d. per lb.

BENZALDEHYDE.—Export inquiries. Price, 2s. 4d. per lb.

DINITROTOLUOL.—Good export inquiries. Price, 10½d. per lb.

DIANISDINE BASE.—Small export inquiry. Price, 22s. 6d. per lb., 100% basis.
DIPHENYLAMINE.—Prices, 2s. 10d. to 3s. per lb.
GAMMA ACID.—Good export inquiry. Price, 10s. 6d. per lb., 100% basis.
METANILIC ACID.—Small export inquiry. Price, 3s. 4d. per lb., 100% basis.
META PHENYLENEDIAMINE.—Some export inquiry. Price, 4s. per lb.
META TOLUYLENEDIAMINE.—Some export inquiry. Price, 4s. 3d. per lb.
NITRO NAPHTHALENE, REFINED.—Small export inquiry. Price, 11d. per lb., f.o.b.
NEVILLE AND WINTHER ACID.—Good export inquiry. Price, 5s. 9d. per lb., 100% basis.
PARA AMIDOSALICYLIC ACID.—Good export inquiry. Price, 8s. 6d. per lb., 100% basis.
PARANITRANILINE.—Home inquiries. Price, 2s. 3½d. lb.
SULPHANILIC ACID.—Small inquiry. Price, 9¼d. lb., 100% basis.
TOLIDINE BASE.—Small export inquiry. Price, 7s. lb., 100% basis.
XYLIDINE.—Small export inquiry. Price, 2s. 1d. per lb., drums included.

The Manchester Chemical Market

(FROM OUR OWN CORRESPONDENT.)

Manchester, June 26, 1924.

THE slight increase in the movement of chemicals reported last week has since been maintained, although most of the business so far as the home trade is concerned is for immediate needs, few buyers showing any marked inclination to commit themselves ahead. In some quarters an increase in the number of inquiries for shipment is reported this week, mainly from the Colonies. Little change in the actual volume of export transactions has, however, occurred. Prices generally keep fairly steady, with here and there a slight movement in favour of buyers.

Heavy Chemicals

Business in prussiate of soda continues on a very small scale, though the current quotation is unchanged at 4½d. per lb. Saltcake is still quoted at £3 10s. per ton to home consumers and £3 for shipment; inquiry for export has improved a little, but domestic buying continues slow. Sulphide of sodium is steady but only in small demand at £14 10s. per ton for 60-65 per cent. concentrated solid and £9 5s. for crystals. Chlorate of soda meets with a moderate inquiry and values are steadier at 2½d. to 2¾d. per lb. Hyposulphite of soda is still a quiet section of the market; photographic crystals are on offer at £14 10s. per ton and commercial at £9 5s. Bleaching powder is quietly steady at £10 per ton. Nitrite of soda is selling very slowly and values are a shade easier at £27 per ton. Caustic soda is steady and in fair demand both from home users and for shipment, quotations ranging from £16 17s. 6d. per ton for 60 per cent. to £19 7s. 6d. for 76-77 per cent. material. Alkali is firm at £6 15s. per ton for 58 per cent., a fair amount of business being put through both branches of trade. Glauber salts are inactive but about unchanged in value at £3 10s. to £3 15s. per ton. Bichromate of soda is steady at 4½d. per lb., a quiet demand being met with. Acetate of soda is steady and in moderate request at £23 to £23 10s. per ton. Phosphate of soda is dull but unchanged from last week at £13 10s. to £14 per ton. The demand for soda crystals is only on quiet lines with values fairly steady at £5 5s. per ton. Bicarbonate of soda is unchanged either in position or value, to-day's quotation being about £10 10s. per ton.

Caustic potash is attracting only a limited amount of buying interest, with values about unchanged from last week at £29 to £30 per ton for 90 per cent. strength. Carbonate of potash is also rather quiet at £23 10s. to £24 per ton. Chlorate of potash has been a shade more active at 2¾d. per lb. Bichromate of potash is steady and in moderate inquiry at 5¾d. per lb. Permanganate of potash is dull and rather easy at 6¾d. to 7¾d. per lb. Prussiate of potash is quiet and supplies are now offering at 7¾d. to 8d. per lb.

Little or no improvement in the position of arsenic can be reported this week and values continue to weaken; white powdered, Cornish makes, is now quoted here at round £50 per ton. Copper sulphate is also rather quiet and slightly easier at £24 10s. per ton, f.o.b. Commercial Epsom salts are steady and in moderate request at about £4 15s. per ton, with magnesium sulphate, B.P., quoted at £6 10s. Grey acetate of lime is quiet but fairly steady at £19 per ton; brown is still rather scarce at £14 10s. Acetate of lead is inactive at £48 for white and £46 per ton for brown. Nitrate of lead is quiet but steady at £43 to £44 per ton.

Acids and Tar Products

Tartaric and citric acids are firm and in moderate demand at 1s. 2d. and 1s. 6d. to 1s. 6½d. per lb. respectively. Acetic acid is fairly steady at £47 for 80 per cent. technical and round £70 per ton for glacial. Oxalic acid keeps dull but about unchanged at 5d. per lb.

The coal-tar products generally are easy and little business is being done. Pitch is still more or less nominal at round £3 per ton, f.o.b. Carbolic acid crystals are quiet and easy at 6½d. per lb., with crude quoted at 1s. 9d. per gallon. Solvent naphtha is offering at about 1s. 4½d. per gallon. Creosote oil is weak at 7¼d. per gallon. Naphthalines are quiet and range from £16 to £16 10s. per ton for refined and £5 and upwards for crude qualities.

Monthly List of Current Prices

The following prices are supplied to THE CHEMICAL AGE *by Messrs. R. W. Greeff & Co., Ltd., and Messrs. Chas. Page & Co., Ltd. These prices, which are given mainly as a guide to works managers, chemists and chemical engineers, apply to fair quantities delivered ex wharf or works, except where otherwise stated.*

General Chemicals

	Per	£	s.	d.		£	s.	d.
Acetic anhydride, 90–95%	lb.	0	1	6	to	0	1	8
Acetone oil	ton	65	0	0	to	70	0	0
Acetone, pure	ton	97	0	0	to	98	0	0
Acid, Acetic, glacial, 99–100%	ton	69	0	0	to	71	0	0
Acetic, 80% pure	ton	46	10	0	to	47	10	0
Acetic, 40% pure	ton	24	0	0	to	24	10	0
Arsenic, liquid, 2000 s.g.	ton	85	0	0	to	88	0	0
Boric, commercial	ton	45	0	0	to	48	0	0
Carbolic, cryst. 39–40%	lb.	0	0	7	to	0	0	7½
Citric	lb.	0	1	6½	to	0	1	7
Formic, 85%	ton	58	0	0	to	60	0	0
Hydrofluoric	lb.	0	0	7	to	0	0	8
Lactic, 50 vol.	ton	37	0	0	to	39	0	0
Lactic, 60 vol.	ton	43	0	0	to	45	0	0
Nitric, 80 Tw.	ton	23	0	0	to	25	0	0
Oxalic	lb.	0	0	4½	to	0	0	4¾
Phosphoric, 1.5	ton	35	0	0	to	38	0	0
Pyrogallic, cryst.	lb.	0	5	9	to	0	6	0
Salicylic, technical	lb.	0	1	9½	to	0	2	0
Sulphuric, 92–93%	ton	5	0	0	to	6	0	0
Tannic, commercial	lb.	0	1	9	to	0	2	0
Tartaric	lb.	0	1	1½	to	0	1	2
Alum, lump	ton	12	10	0	to	13	0	0
Chrome	ton	23	0	0	to	24	0	0
Alumino ferric	ton	7	0	0	to	7	5	0
Aluminium, sulphate, 14–15%	ton	7	0	0	to	7	15	0
Sulphate, 17–18%	ton	8	0	0	to	8	10	0
Ammonia, anhydrous	lb.	0	1	6	to	0	1	8
.880	ton	32	0	0	to	34	0	0
.920	ton	22	0	0	to	24	0	0
Carbonate	ton	37	0	0	to	39	0	0
Chloride	ton	50	0	0	to	55	0	0
Muriate (galvanisers)	ton	32	0	0	to	33	0	0
Nitrate (pure)	ton	40	0	0	to	45	0	0
Phosphate	ton	63	0	0	to	65	0	0
Sulphocyanide, commercial 90%	lb.	0	1	5	to	0	1	6
Amyl acetate, technical	ton	195	0	0	to	200	0	0
Arsenic, white powdered	ton	48	0	0	to	50	0	0
Barium, carbonate, Witherite	ton	5	0	0	to	6	0	0
Carbonate, Precip.	ton	15	0	0	to	16	0	0
Chlorate	ton	61	0	0	to	63	0	0
Chloride	ton	12	10	0	to	14	0	0
Nitrate	ton	37	0	0	to	40	0	0
Sulphate, blanc fixe, dry	ton	20	10	0	to	21	0	0
Sulphate, blanc fixe, pulp	ton	10	5	0	to	10	10	0
Sulphocyanide, 95%	lb.	0	0	11	to	0	1	0
Bleaching powder, 35–37%	ton	10	0	0	to	10	10	0
Borax crystals, commercial	ton	25	0	0	to	—		
Calcium acetate, Brown	ton	13	0	0	to	14	0	0
Grey	ton	18	0	0	to	19	0	0
Carbide	ton	13	0	0	to	13	10	0
Chloride	ton	5	15	0	to	6	0	0
Carbon bisulphide	ton	28	0	0	to	30	0	0
Casein technical	ton	60	0	0	to	65	0	0
Cerium oxalate	lb.	0	3	0	to	0	3	6
Chromium acetate	lb.	0	1	1	to	0	1	3
Cobalt acetate	lb.	0	5	0	to	0	5	6
Oxide, black	lb.	0	8	6	to	0	9	0

	Per	£	s.	d.		£	s.	d.
Copper chloride	lb.	0	1	1	to	0	1	2
Sulphate	ton	24	0	0	to	24	10	0
Cream tartar, 98–100%	ton	83	0	0	to	84	0	0
Epsom salts (*see* Magnesium sulphate)								
Formaldehyde, 40% vol.	ton	55	0	0	to	57	0	0
Formusol (Rongalite)	lb.	0	1	11	to	0	2	0
Glauber salts commercial	ton	3	10	0	to	4	0	0
Glycerin crude	ton	65	0	0	to	67	10	0
Hydrogen peroxide, 12 vols.	gal.	0	1	10	to	0	2	0
Iron perchloride	ton	20	0	0	to	22	0	0
Sulphate (Copperas)	ton	3	10	0	to	4	0	0
Lead acetate, white	ton	48	0	0	to	49	0	0
Carbonate (White Lead)	ton	45	0	0	to	50	0	0
Nitrate	ton	44	0	0	to	44	10	0
Litharge	ton	42	0	0	to	45	0	0
Lithophone, 30%	ton	22	10	0	to	23	0	0
Magnesium chloride	ton	4	0	0	to	4	5	0
Carbonate, light	cwt.	2	10	0	to	2	15	0
Sulphate (Epsom salts commercial)	ton	5	5	0	to	5	15	0
Sulphate (Druggists')	ton	9	0	0	to	10	0	0
Manganese Borate, commercial	ton	65	0	0	to	75	0	0
Sulphate	ton	45	0	0	to	48	0	0
Methyl acetone	ton	78	0	0	to	80	0	0
Alcohol, 1% acetone	ton	73	0	0	to	75	0	0
Nickel sulphate, single salt	ton	37	0	0	to	38	0	0
Ammonium sulphate double salt	ton	37	0	0	to	38	0	0
Potash, Caustic	ton	32	0	0	to	33	0	0
Potassium bichromate	lb.	0	0	5½	to		—	
Carbonate, 90%	ton	24	0	0	to	26	0	0
Chloride, 80%	ton	9	0	0	to	10	0	0
Chlorate	lb.	0	0	3½	to		—	
Metabisulphite, 50–52%	ton	63	0	0	to	65	0	0
Nitrate, refined	ton	38	0	0	to	40	0	0
Permanganate	lb.	0	0	7½	to	0	0	8
Prussiate, red	lb.	0	1	9	to	0	2	0
Prussiate, yellow	lb.	0	0	8½	to	0	0	8½
Sulphate, 90%	ton	10	0	0	to	10	10	0
Salammoniac, firsts	cwt.	2	5	0	to		—	
Seconds	cwt.	2	7	6	to		—	
Sodium acetate	ton	23	15	0	to	24	0	0
Arsenate, 45%	ton	43	0	0	to	45	0	0
Bicarbonate	ton	10	10	0	to	11	0	0
Bichromate	lb.	0	0	4½	to		—	
Bisulphite, 60–62%	ton	19	0	0	to	20	0	0
Chlorate	lb.	0	0	2½	to	0	0	3
Caustic, 70%	ton	17	10	0	to	18	0	0
Caustic, 76%	ton	18	10	0	to	19	0	0
Hydrosulphite, powder	lb.	0	1	6	to	0	1	7
Hyposulphite, commercial	ton	10	0	0	to	10	10	0
Nitrite, 96–98%	ton	27	0	0	to	28	0	0
Phosphate, crystal	ton	14	0	0	to	14	10	0
Perborate	lb.	0	0	11	to	0	1	0
Prussiate	lb.	0	0	4¼	to	0	0	4½
Sulphide, crystals	ton	8	10	0	to	9	0	0
Sulphide, solid, 60–62%	ton	15	0	0	to	16	10	0
Sulphite, cryst.	ton	11	10	0	to	12	0	0
Strontium carbonate	ton	50	0	0	to	55	0	0
Nitrate	ton	50	0	0	to	55	0	0
Sulphate, white	ton	6	10	0	to	7	10	0
Sulphur chloride	ton	25	0	0	to	27	10	0
Flowers	ton	9	0	0	to	9	10	0
Roll	ton	8	10	0	to	9	0	0
Tartar emetic	lb.	0	0	11	to	0	1	0
Tin perchloride, 33%	lb.	0	1	4	to	0	1	5
Perchloride, solid	lb.	0	1	5	to	0	1	6
Protochloride (tin crystals)	lb.	0	1	5	to	0	1	6
Zinc chloride 102° Tw.	ton	19	0	0	to	20	0	0
Chloride, solid, 96–98%	ton	25	0	0	to	30	0	0
Oxide, 99%	ton	42	0	0	to	45	0	0
Dust, 90%	ton	50	0	0	to	55	0	0
Sulphate	ton	13	10	0	to	13	15	0

Pharmaceutical Chemicals

Acetyl salicylic acid	lb.	0	3	4	to	0	3	6
Acetanilid	lb.	0	2	4	to	0	2	6
Acid, Gallic, pure	lb.	0	3	0	to	0	3	3
Lactic, 1.21	lb.	0	2	9	to	0	3	0
Salicylic, B.P.	lb.	0	1	10	to	0	2	0
Tannic, leviss	lb.	0	3	0	to	0	3	3
Amidol	lb.	0	8	6	to	0	9	0
Amidopyrin	lb.	0	13	6	to	0	14	0
Ammon ichthosulphonate	lb.	0	1	10	to	0	2	0
Barbitone	lb.	0	14	6	to	0	15	0
Beta naphthol resublimed	lb.	0	3	6	to	0	4	0
Bromide of ammonia	lb.	0	0	10	to	0	0	11
Potash	lb.	0	0	8	to	0	0	8½
Soda	lb.	0	0	8½	to	0	0	9

	Per	£	s.	d.		£	s.	d.
Caffeine, pure	lb.	0	12	0	to	0	12	6
Calcium glycerophosphate	lb.	0	5	9	to	0	6	0
Lactate	lb.	0	1	6	to	0	1	9
Calomel	lb.	0	3	9	to	0	4	0
Chloral hydrate	lb.	0	3	10	to	0	4	0
Cocaine alkaloid	oz.	1	0	0	to	1	2	6
Hydrochloride	oz.	0	17	0	to	0	17	6
Corrosive sublimate	lb.	0	3	3	to	0	3	6
Eucalyptus oil, B.P. (70–75% eucalyptol)	lb.	0	2	0	to	0	2	2
B.P. (75–80% eucalyptol)	lb.	0	2	1	to	0	2	3
Guaiacol carbonate	lb.	0	11	9	to	0	12	0
Liquid	lb.	0	10	6	to	0	11	0
Pure crystals	lb.	0	11	0	to	0	11	6
Hexamine	lb.	0	3	9	to	0	4	0
Hydroquinone	lb.	0	4	6	to	0	5	0
Lanoline anhydrous	lb.	0	0	8	to	0	0	9
Lecithin ex ovo	lb.	1	5	0	to	1	7	6
Lithi carbonate	lb.	0	9	9	to	0	10	3
Methyl salicylate	lb.	0	2	6	to	0	2	9
Metol	lb.	0	11	6	to	0	13	6
Milk sugar	cwt.	3	17	6	to	4	5	0
Paraldehyde	lb.	0	1	5	to	0	1	7
Phenacetin	lb.	0	6	0	to	0	6	6
Phenazone	lb.	0	7	6	to	0	8	0
Phenolphthalein	lb.	0	7	3	to	0	7	6
Potassium sulpho guaiacolate	lb.	0	6	3	to	0	6	9
Quinine sulphate, B.P.	oz.	0	2	3	to		—	
Resorcin, med cinal	lb.	0	5	6	to	0	6	0
Salicylate of soda powder	lb.	0	2	4	to	0	2	6
Crystals	lb.	0	2	6	to	0	2	9
Salol	lb.	0	4	0	to	0	4	3
Soda Benzoate	lb.	0	2	9	to	0	3	0
Sulphonal	lb.	0	16	0	to	0	16	6
Terpene hydrate	lb.	0	1	9	to	0	2	0
Theobromine, pure	lb.	0	12	0	to	0	12	3
Soda salicylate	lb.	0	8	6	to	0	9	0
Vanillin	lb.	1	5	6	to	1	8	0

Coal Tar Intermediates, &c.

Alphanaphthol, crude	lb.	0	1	9	to	0	2	0
Refined	lb.	0	2	3	to	0	2	6
Alphanaphthylamine	lb.	0	1	6½	to	0	1	7
Aniline oil, drums extra	lb.	0	0	8½	to	0	0	8¾
Salts	lb.	0	0	9	to	0	0	9¼
Anthracene, 40–50%	unit	0	0	8½	to	0	0	9
Benzaldehyde (free of chlorine)	lb.	0	2	9	to	0	3	0
Benzidine, base	lb.	0	4	4	to	0	4	7
Sulphate	lb.	0	3	4	to	0	3	7
Benzoic acid	lb.	0	2	0	to	0	2	3
Benzyl chloride, technical	lb.	0	2	0	to	0	2	3
Betanaphthol	lb.	0	1	1	to	0	1	2
Betanaphthylamine, technical	lb.	0	4	0	to	0	4	3
Croceine Acid, 100% basis	lb.	0	3	3	to	0	3	6
Dichlorbenzol	lb.	0	0	9	to	0	0	10
Diethylaniline	lb.	0	4	6	to	0	4	9
Dinitrobenzol	lb.	0	1	1	to	0	1	2
Dinitrochlorbenzol	lb.	0	0	10	to	0	0	11
Dinitronaphthalene	lb.	0	1	4	to	0	1	5
Dinitrotoluol	lb.	0	1	3	to	0	1	4
Dinitrophenol	lb.	0	1	6	to	0	1	7
Dimethylaniline	lb.	0	2	8	to	0	2	10
Diphenylamine	lb.	0	3	0	to	0	3	3
H-Acid	lb.	0	4	3	to	0	4	6
Metaphenylenediamine	lb.	0	4	0	to	0	4	3
Monochlorbenzol	lb.	0	0	10	to	0	1	0
Metanilic Acid	lb.	0	5	9	to	0	6	0
Metatoluylenediamine	lb.	0	4	0	to	0	4	3
Monosulphonic Acid (2.7)	lb.	0	8	6	to	0	9	6
Naphthionic acid, crude	lb.	0	2	4	to	0	2	6
Naphthionate of Soda	lb.	0	2	4	to	0	2	6
Naphthylamine-di-sulphonic-acid	lb.	0	4	0	to	0	4	3
Neville Winther Acid	lb.	0	7	3	to	0	7	9
Nitrobenzol	lb.	0	0	7	to	0	0	8
Nitronaphthalene	lb.	0	0	11½	to	0	1	0
Nitrotoluol	lb.	0	0	8	to	0	0	9
Orthoamidophenol base	lb.	0	12	0	to	0	12	6
Orthodichlorbenzol	lb.	0	1	0	to	0	1	1
Orthotoluidine	lb.	0	0	10	to	0	0	11
Orthonitrotoluol	lb.	0	0	3	to	0	0	4
Para-amidophenol base	lb.	0	8	6	to	0	9	0
Hydrochlor	lb.	0	7	6	to	0	8	0
Paradichlorbenzol	lb.	0	0	9	to	0	0	10
Paranitraniline	lb.	0	2	6	to	0	2	8
Paranitrophenol	lb.	0	2	3	to	0	2	6
Paranitrotoluol	lb.	0	2	9	to	0	3	0
Paraphenylenediamine, distilled	lb.	0	12	0	to	0	12	6
Paratoluidine	lb.	0	5	6	to	0	5	9

Company News

BRITON FERRY CHEMICAL AND MANURE CO.—A dividend for the half year will be paid on July 1 on the 7 per cent. preference shares, less tax.

ALLEN-LIVERSEDGE, LTD.—A dividend at the rate of 12½ per cent. per annum (less tax) is announced for the six months ended April 30, 1924.

DE BEERS CONSOLIDATED MINES CO.—A dividend of 20 per cent., free of Union dividend tax, is recommended on the deferred shares for the past year.

TARSLAG (1923), LTD.—A dividend is announced at the rate of 8 per cent. per annum on the cumulative preference shares for the six months ending June 30.

BOOTS PURE DRUG CO.—The directors have declared an interim dividend on the ordinary shares for the quarter ending June 30 at the rate of 9 per cent., less tax.

CORDOBA COPPER CO., LTD.—A meeting will be held at 3 p.m. on July 4 at the Cannon Street Hotel, London, to consider a scheme for the reconstruction of the company.

ESPERANZA COPPER AND SULPHUR CO.—The directors in their report for the year 1923 propose a dividend of 1s. per share, against nil in the previous year. The profit for the year amounted to £10,845.

TEHIDY MINERALS, LTD.—The profit for the year 1923 amounted to £1,565, and £1,161 was brought forward. After deducting corporation tax £252 and writing off balance of underwriting commission £223, there remains £2,251 to be carried forward.

NEUCHATEL ASPHALTE CO.—The profit for the year 1923, after providing for depreciation, etc., amounted to £43,372, and £4,892 was brought in, making £48,264. The directors recommend a dividend of 1s. on the ordinary shares, less tax, carrying forward £13,402.

PHILIP HARRIS AND CO.—The directors report a net profit of £6,092 for the year to March 31 last. The dividend for the year on both the preference and the ordinary shares is 7½ per cent., the same as last year, and £543 is transferred to reserve for depreciation, leaving £12,305 to be carried forward.

BROUGHTON COPPER CO.—The report for the year ended March last states that the profit was £53,040, and out of the available balance of £42,100 the directors propose to place to the reserve account £10,000, to pay a preference dividend of 5 per cent. for the six months ended March, and a final dividend on the ordinary shares of 10 per cent., making with the interim dividend already paid 12½ per cent. for the year, carrying to new account £5,750.

COMPANIA SALITRERA LASTENIA CO.—With reference to the option to the shareholders of the Compania Salitrera Lastenia of selling their shares to the Lautaro Nitrate Co., Ltd., the board of the latter company notify holders of share warrants to bearer in the Lastenia Co. who are desirous of availing themselves of the offer that they must lodge their certificates before September 30 next with the Anglo-South American Bank, 62, Old Broad Street, London, E.C. The allotment of Lautaro shares will be made on October 1.

New Chemical Trade Marks

Applications for Registration

This list has been specially compiled for us by Mr. H. T. P. Gee, Patent and Trade Mark Agent, 51 and 52, Chancery Lane, W.C.2, from whom further information may be obtained. Opposition to the registration of the following Trade Marks can be lodged up to July 25, 1924.

"KALOSAN."

446,325. For chemical substances prepared for use in medicine and pharmacy, but not including preparations for the treatment of corns, and not including any goods of a like kind to any of these excluded goods. The British Drug Houses, Ltd., 22 to 30, Graham Street, City Road, London, N.1; wholesale druggists. March 14, 1924. (To be Associated, Sect. 24.)

"CUTIE-GIRL."

448,487. For dyes. Wm. Edge and Sons, Ltd., 50, Raphael Street, Bolton, Lancashire, manufacturing chemists and dye merchants. May 19, 1924. (To be Associated, Sect. 24).

"ALPHANONE."

446,002. For ionone, being a chemical substance for use in manufactures. A. Boake, Roberts and Co., Ltd., 100, Carpenter's Road, Stratford, London, E.15, manufacturing chemists. March 5, 1924. (To be associated. Sect. 24.)

"VISBA."

447,172 and 447,173. For chemical substances for use in the dyeing and printing of textile fabrics. Class I. Geigy Societe Anonyme (a joint stock company organised under the laws of the Republic of Switzerland), 51 and 57, Riehenring, Basle, Switzerland, manufacturers. April 4, 1924. (To be associated. Sect. 24.)

"TIO."

448,107. For chemical substances used for agricultural and horticultural purposes. Murphy and Son, Ltd., The Cedars, Sheen Lane, Mortlake, London, S.W.14, technical chemists. May 6, 1924.

"PARAMAG."

445,595. For chemical substances prepared for use in medicine and pharmacy, but not including ointments and dermatological preparations, and not including any goods of a like kind to ointments and dermatological preparations. John Bell, Hills and Lucas, Ltd., Oxford Works, 14, Tower Bridge Road, London, S.E.1, wholesale druggists. February 21, 1924. (By consent.)

"NUJOL."

446,536. For chemical substances prepared for use in medicine and pharmacy. Standard Oil Co. (a Corporation organised and existing under the laws of the State of New Jersey), Constable Hook, Bayonne, Hudson County, New Jersey, United States of America, refiners of oil, manufacturers and merchants. March 19, 1924. (To be associated. Sect. 24.)

"IMBAK."

447,863. For chemical substances prepared for use in medicine and pharmacy. Haller Laboratories, Ltd., 325, Borough High Street, London, S.E.1, manufacturing chemists. April 28, 1924. (To be associated. Sect. 24.)

Chemical Trade Inquiries

The following inquiries, abstracted from the "Board of Trade Journal," have been received at the Department of Overseas Trade (Development and Intelligence), 35, Old Queen Street, London, S.W.1. British firms may obtain the names and addresses of the inquirers by applying to the Department (quoting the reference number and country), except where otherwise stated.

CENTRIFUGAL SEWAGE PUMPS.—The City of Toronto Department of Works (Sewer Section) is inviting tenders for the supply and installation of two centrifugal sewage pumps. Further particulars may be obtained from the Department of Overseas Trade. Ref. No. A.X./1081.

CENTRIFUGAL SLUDGE PUMP.—Tenders are invited by the City of Toronto Department of Works (Sewer Section) for the supply and installation at their main sewage pumping station, Eastern Avenue, Toronto, of one centrifugal sludge pump. Further particulars from the Department of Overseas Trade. (Ref. No. A.X./1082.)

OILS FOR SOAP MANUFACTURE.—A commission agent in Santiago, Chile, is desirous of representing British firms manufacturing raw products, such as oils used by soap manufacturers. (Ref. No. 753).

MARKET FOR PHOTOGRAPHIC MATERIALS.—British firms desirous of receiving a confidential report on the market for photographic apparatus and materials in Chile, specially prepared by the Department of Overseas Trade, from information supplied by the Commercial Secretary at Santiago, should apply to the Department. (Ref. No. B.X./1017.)

SULPHATE OF COPPER.—An agent at Tours, France, is desirous of obtaining the representation of British firms for the sale of sulphate of copper. (Ref. No. 734).

CHEMICALS FOR ITALY.—A firm at Milan desires to obtain exclusive agencies of British manufacturers of artificial silk and chemical products connected with the textile industry. (Ref. No. 742).

MARKET FOR PAINTS IN ITALY (PART II.).—A confidential report on the market for paints, etc., in the Venice and Murano districts has been prepared by the Department of Overseas Trade. (Ref. No. B.X./1040.)

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

EASIT (MANCHESTER), LTD., 9, Lower Chatham Street, Chorlton-on-Medlock, ointment makers. (C.C., 28/6/24.) £11 4s. 10d. May 16.

MODERN MEDICINE, LTD., Bush House, Aldwych, patent medicine proprietors. (C.C., 28/6/24.) £41 7s. 2d. May 9.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

AGOS, LTD., Shenstone, Staffs, fertilizer manufacturers. (M., 28/6/24.) Registered June 10, £1,000 debentures; general charge. *Nil. January 23, 1923.

GORDON (H.) (LONDON), LTD., druggists' sundriesmen. (M., 28/6/24.) Registered June 13, £10,000 debentures (filed under section 93 (3) of the Companies' (Consolidation) Act, 1908), present issue, £6,000; general charge. *——. March 10, 1924.

MORNY FRERES, LTD., London, W., chemists. (M., 28/6/24.) Registered June 12, mortgage to bank; charged on building agreement relating to 199 and 201 Regent Street, and 66, Conduit Street, W., and leases to be granted thereunder. *Nil. August 10, 1922.

MURRAY (S.) AND CO., LTD., London, E.C., druggists. (M., 28/6/24.) Reg. June 10, £1,500 mortgage, to bank; charged on first, second and third floors, 13, Farringdon Road, E.C. *£2,000. November 29, 1923.

London Gazette

Company Winding Up

THE UNITED LABORATORIES AND CHEMICAL CO., LTD., 97, Queen Victoria Street, London. (C.W.U., 28/6/24.) Meetings of creditors, July 3, 11.30 a.m., and contributories, July 3, 12 noon, 33, Carey Street, Lincoln's Inn, London, W.C.2.

Companies Winding Up Voluntarily

BRITONIA POLISH CO., LTD. (C.W.U.V., 28/6/24.) S. H. Bond, 11, Winckley Street, Preston, chartered accountant, appointed liquidator. Meeting of creditors at liquidator's office, on Thursday, July 3, at 3 p.m. Creditors' claims by July 10.

LANDORE CHEMICAL PAINT CO., LTD. (C.W.U.V., 28/6/24.) A. E. Goskar, accountant, 61, Wind Street, Swansea, appointed liquidator. Meeting of creditors at the liquidator's office, July 4, at 3 p.m. Creditors' claims by July 31.

Bankruptcy Information

WEBB, Charles, trading with another person at 99, Great George Street, Liverpool, chemical manufacturer. First meeting, July 1, 11.30 a.m., at office of the Official Receiver, 11, Dale Street, Liverpool. Public examination, July 15, 10.30 a.m., Court House, Government Buildings, Victoria Street, Liverpool.

New Companies Registered

ANDREW AUSTIN (RUSHDEN), LTD., Inchester Road, Rushden. Wax and polish manufacturers. Nominal capital, £15,000 in £1 shares.

BENNISONS, LTD., 8, Cale Street, Chelsea, London, S.W. Wholesale and retail chemists, druggists, drysalters, oil and colourmen, etc. Nominal capital, £5,000 in 1,000 7 per cent. cumulative preference and 4,000 ordinary shares of £1 each.

B.I.A. SYNDICATE, LTD., Sentinel House, Southampton Row, London, W.C. To adopt an agreement with J. J. P. Tomlinson for the acquisition from him of the benefit of the research and technical and other information as to the obtaining, preparation and general exploitation of alcohol for industrial purposes. Nominal capital, £500 in 1s. shares.

CALCINING, LTD. Manufacturers and importers of and dealers in acids and other industrial, chemical, etc., preparations. Nominal capital, £1,000 in £1 shares (300 "A" and 700 "B.") Solicitors: B. Hoddinott and Son, Moorgate Station Chambers, London, E.C.2.

SHAW'S TANNERIES, LTD., Earles Fields Works, Grantham, Lincs. Leather dressers and tanners, chemists, druggists, drysalters, oil and colourmen, etc. Nominal capital, £150,000 in £1 shares (75,000 7 per cent. cumulative preference and 75,000 ordinary).

H. E. WILSON (1924), LTD., 9, Strand Street, Liverpool. Paint manufacturers, dealers in wallpapers, chemical, industrial and other preparations, etc. Nominal capital, £3,000 in £1 shares.

International Foundry Trades Exhibition

THE International Foundry Trades Exhibition, opened at Bingley Hall, Birmingham, on Thursday, June 19, closes to-day (Saturday). Many chemical exhibits were included. The Stella Gell Coke and By-Products Co., of Newcastle, had an interesting exhibit of coke, sulphate of ammonia, crude benzol, hot pressed naphthalene and pitch and salty creosote; and patent foundry furnace coke and coke nuts were shown by the Marley Hill Chemical Co., of Lombard Street, London. The Yorkshire Amalgamated Products, Ltd. of Doncaster, exhibited steel foundry sands, silica cement, silica bricks and blocks for cupola linings. The display of the General Refractories Co., Ltd., of Sheffield, included magnesite and chrome bricks, and silica bricks and ganister for lining cupolas, powdered and pea-size magnesite and chrome, which is used as a cement. Preservatives and anti-corrosives were featured by the Atlas Preservative Company of Deptford; an anti-corrosive paint, it was claimed, absorbed and neutralised the rust particles present at application.

Industrial Spirit from Potatoes

IT is reported from Australia that the flotation of a company in Melbourne to manufacture alcohol industrial spirit from potatoes by the continual distillation process is under consideration. Should it be decided to launch the undertaking, the Federal Government is to be asked to assist in placing the new industry on a sound foundation by granting a bonus of 1s. a gallon and raising the duty on imported power spirit from 1d. to 1s. a gallon. The Victorian Government is to be asked for a bonus of £1 a ton for all potatoes turned into methylated spirit. This, it is claimed, would give a great impetus to the growth of potatoes and encouragement to immigration and land settlement. It is pointed out that over 35,000,000 gallons of petroleum spirit are imported every year, at a cost of £5,000,000.

French Dyestuff Makers

THE Etablissements Kuhlmann, who are among the largest French coal-tar colour manufacturers, have issued a balance sheet showing a net profit of 20 million francs, as against 7 million francs the previous year. This company was amalgamated with the leading French dyestuff makers, the Compagnie Nationale de Matières Colorantes, twelve months ago, and has since had the benefit of German technical assistance as conceded by agreement to the Matière Colorantes. The capital of the Etablissements Kuhlmann is 150 million francs. A dividend of 30 francs, as against 20 francs, per share is being paid.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

1923-1924

In this, the first issue of *The China Clay Trade Review* for the year 1924, we take the opportunity of wishing our readers in all parts of the world, the oft-repeated, but none-the-less sincere wish of "a prosperous New Year."

The China Clay trade, during the year that has just passed, whilst it might have been better, cannot be said to have been a bad one, with a total tonnage of 820,393, though this is still below the best post-war year of 1920.

When it is remembered that the rate of exchange has made it difficult, and in some cases almost impossible, for several of the European countries to purchase from us, there is every reason for congratulation that the volume of trade has been so great.

The China Clay producers are hopeful of the future, and during 1923 much constructional work has been undertaken, new kilns have been erected by Messrs. Parkyn and Peters, English China Clays, Ltd., Cornish Kaolins, Ltd., Tehidy Minerals, Ltd., Pochin and Co., Ltd., John Lovering and Co., United China Clays, Ltd., and others.

Perhaps one of the most interesting innovations in the trade during 1923 was the installation of an oil burning kiln, of which we gave a full description at the time in these pages. The opening of No. 8 jetty and elevator at Fowey by the G.W. Railway Co. in September last, at a cost of approximately £300,000, was the occasion for a very representative gathering of China Clay producers, who at last saw their hopes of quicker dispatch realised.

The Railway Co. are fully alive to the needs of the China Clay industry, both export and home, and by the construction of this jetty and apparatus have shewn a keen anxiety to promote the prosperity of the trade.

A much greater volume of trade has recently been sent by rail, as our monthly figures shew, and in this connection the article we print in this issue on "Transport of China Clay to the Potteries," will be read with interest. It is a very welcome fact that our home markets have had such a share in the revival of trade during 1923. The home paper mills, the potteries and the textile trade have all contributed to this increase. America has, of course, been the chief consumer of China Clay from Cornwall and Devon, and with our present transport facilities we ought to be in a position to compete with even the cheaper priced American clays, which, as our correspondents have more than once pointed out in these pages, are being extensively developed. The Associated China Clays, Ltd., has done much valuable work on behalf of the industry since its formation, and consumers know that its working has been fair to them. Whenever an opportunity of decreasing prices has been possible, and even at times when there was nothing to justify it, prices have been lowered. There are always to be found some buyers who will complain of such an association as a "Trust" which they are out to break, and talk high-handedly of purchasing all their supplies outside such a "ring."

Some of the worst offenders in this respect have been men who belong to exactly similar associations in their own trades.

The Association has, however, a clear conscience, in that it has never profiteered, whilst it has done much to uplift the China Clay industry.

New uses are being discovered for China Clay, and research work of an interesting character has been undertaken during the preceding year. Collodial clay has now been put on the market by several firms, which it is believed will find entirely new markets.

Foreign Exchanges and China Clay

It is no part of our duty as a trade paper to discuss the wisdom of the occupation of the Ruhr by the French, but no one can doubt that the immediate result was the depreciation of the German mark, and to-day it looks as though the depreciation of the French franc was to become an even more serious factor in the purchasing power of France than it was during last year.

Whilst the China Clay industry has been directly cut off from supplying in any quantities to these countries owing to their depreciated currencies, it has also hit us indirectly. The Board of Trade returns show that our friends in the paper industry are acutely feeling the imports of paper from Germany into the United Kingdom owing to their low rate of German exchange. Many British papermaking firms had to close down their mills in 1923. The textile, cotton and wool trades suffered last year, and thus the Lancashire mills supplying wrapping paper have been greatly depressed. The paper mills are the largest purchasers of China Clay, and causes which affect the output of paper react on the China Clay trade immediately. The settlement and restoration of the European currencies is of vital importance to the China Clay industry, and one wonders why a more determined effort has not been made before this to put the whole vexed question on a better footing. Until this difficult task is accomplished there will be no lasting improvement in trade. It should not be beyond the power of our legislators if they can be persuaded to drop party politics for the country's good and take His Majesty's New Year message as their guide for 1924:—"I am confident that with God's help the British, true to their great traditions, will face and overcome those difficulties that still confront us at the close of a decade which, though memorable in glorious achievement, has been beset by much trial and suffering."

On another page we have given the impressions of prominent producers of the past year's trade and the prospects for this year.

Although of widely varying views they will be found helpful to readers, as also will the reprint of Mr. Collins's article dealing with profit and output of the China Clay industry.

1923 and Prospects for 1924

Some Views of Prominent Producers

Mr. C. Stuart Varcoe

It is very gratifying at the beginning of the second year of our reorganised China Clay Trade Review to have a retrospective glance at the progress made during the past year. The year 1923 may not have been an exciting one, but it is doubtful whether any period will compare with it for general and gradual advancement. One of its distinguishing features was the opening of the new jetty at Fowey, and despite its imperfect completion it is looked upon as an immense move onwards in the vanguard of progress, and when those obstacles which are at present denuding it of the high expectations of the trade are smoothed out, the industry will receive an impetus which will be felt throughout the community. For years shippers have complained of the delay at Fowey, and although no producer dare to hope that the freights to New York will be reduced to those obtaining 60 years ago, when China Clay was carried from Liverpool to New York for 1s. 6d. per ton, producers are naturally of the opinion that when loading becomes accelerated freights will consequently lower.

It was with the object of confirmation that a representative of The China Clay Trade Review called upon Mr. C. Stuart Varcoe, the St. Austell director of the firm of Messrs. Varcoe's China Clays, Ltd., of St. Austell, with branch establishments at Stoke-on-Trent, Manchester, and on the Continent. The visit to the firm's fine official establishment at St. Austell was certainly made at a psychological moment, when Mr. Varcoe found time and was disposed to give us his impressions, which are matured by long experience and thorough acquaintance with the industry and should be of inestimable value to our readers.

Regarding the past year, Mr. Varcoe said that the volume of business throughout the year had been quite satisfactory. There had been a few lean months, but the year's trade as a whole had been as good as most of them had anticipated. The American market, as is well known, had been their best plank for many years, and the demand for their best paper clays shows a continuous and gradual movement in the right direction. In Mr. Varcoe's opinion there was room for even greater development of our business relations with the United States, particularly with regard to our commoner class clays. There appear to be greater possibilities for these cheaper clays than is generally recognised, providing it can be sold cheaper. The industry possesses an enormous quantity of common clays, and the problem that presents itself ought to be capable of solution, and would confer an incalculable boon to the whole community.

The trade on the Continent, despite the adverse effects of the exchange, has been well maintained, and a considerable accession of business may be expected with France with the improvement of the rates of exchange. There is very little, if any, unemployment in France, which emphasises the fact that that country is recovering her industrial activity rather more rapidly than our own, and more China Clay business may be expected with France in the near future.

Adverting to the American exports, Mr. Varcoe remarked that there had been complaints from the steam ship companies for a number of years on account of the very slow loading, but with the provision of such a modern mechanical elevator as the Great Western Railway had constructed at Fowey shipping should be greatly accelerated.

The Ball Clay industry has been remarkably active, and the demand for the best English Ball Clays appears to be received from the Potteries in all parts of the world, and Mr. Varcoe was pleased to inform us that his firm had been instrumental in the exploitation of a very large Ball Clay deposit in South Devon. Operations have been in progress some time, and the samples of the clay already obtained bear comparison with the best Devonshire Ball Clay for its plastic, bonding, carbonaceous and vitrifying properties. The Ball Clay business seems to have quite a monopoly of its own, notwithstanding the fact that there are Ball Clay deposits in other countries. The firm is connected with the only felspar mine now working in the British Isles. In this direction they have experienced a very successful period, especially during the past year. Felspar supplies an important raw material to glass manufacturers as well as potters, the markets for which have been exceptionally good, and the outlook for this very interesting product is most encouraging.

An interesting feature of the firm's activities during the past year has been the evolution of an offspring, the Cornwall Porcelain Clays, Ltd., which has undertaken the development of some of the separated China Clay mines, China Stone quarries and grinding mills; but the distribution and sales control is still retained by the parent directorate.

It is fortunate that the comapny retains its family name, as their clays have become so familiar in all parts of the world, and the frequent visits of the managing director, Mr. C. Stuart Varcoe, to the paper manufacturers, both at home and abroad, enables him to meet the requirements of their clients. Varcoe's potting clays have been for many generations a speciality, and it is observed with interest Messrs. William Varcoe and Sons supplied China Clay and China Stone to the manufacturers of St. John's Chinaware of Quebec as far back as 1870, largely on account of the fact that the managing director has spent eight years of his early business training in one of the important pottery manufactures in Staffordshire, thus affording him an opportunity of catering for the especial needs of the trade so satisfactorily.

Within the past few years the firm have also added to their sales control department the large mines of the Tehidy Minerals, Ltd., and the Cornish Kaolin, Ltd. The latter mines, which are largely under the administration of Capt. A. H. Moreing, are expanding rapidly.

As will be seen, the establishment of Varcoe's China Clays, Ltd., is a virile institution, and has already conferred an inestimable benefit upon Cornish trade and enterprise, and in virtue of its capable management may be expected to achieve even greater progress than that which has already marked their career in the past.

Mr. Walter Sessions

The beginning of a New Year provides an exceptionally opportune moment for some retrospective opinions on the China Clay industry, and it was rather fortunate that our St. Austell Representative should have met Mr. Walter Sessions at the Head Offices of English China Clays, Ltd., of which he is one of the managing directors. Although the ideas expressed by Mr. Sessions may be regarded as somewhat differing from the accepted opinion of the China Clay county of Cornwall, they may, none the less, direct us to the very root of our industrial difficulties. Few representatives of the China Clay industry have travelled in other countries so extensively as Mr. Sessions, and fewer still have been brought into closer range with the actualities of our foreign competition. Then surely the impressions of such an ambassador of our own staple industry is deserving of very careful consideration.

Mr. Sessions, who was in America early in November, said the shipments of English China Clay to the United States were much better than in the previous year. U.S.A.'s industrial production generally reached its highest peak in June of last year, according to the announcements of the American banking interests, which synchronised with the largest monthly output of China Clay in recent years over that period. During the latter half of 1923, however, this commercial activity was not sustained. The falling off was considerable, some large American paper makers only working 60 per cent. of their normal output. The potteries, on the other hand, were still very busy with long term contracts in hand.

Tariffs have largely helped to produce work in U.S.A., generally including the potteries and textile industries, and by such means outside competition is eliminated largely, if not entirely, while U.S.A. producers can dump into England and Holland large quantities of manufactured goods, because they have no such protection.

The stocks generally in U.S.A. are low, and a term of manufacturing prosperity is looked for in 1924. This would be very welcome to producers of China Clay, but unfortunately the English producer of China Clay does not, or will not, realise the increased production and use of domestic clays in the United States and elsewhere. The English producer still thinks in his confined environment, and as long as his China Clay Association exists with its intricacies and multitude of rules and regulations, he does not set his mind to the great issues affecting the whole English China Clay industry. Until the whole of the producers and the royalty owners place their interests in one financial control, there can be little prospect of permanent extension and remunerative development of our own industry. Even a settlement of the European situation would bring only a limited benefit to the English China Clay production under the present conditions of working. The domestic clays of various countries, of which there are large deposits, can successfully compete and take the place of English China Clays. When the English industry is once in a position to sell freely without let or hindrance, in quantities and prices, then, and only then, will the trade develop and double the present employment. It is appalling, remarked Mr. Sessions, to see how those protected countries are securing the markets that used to belong to the English manufacturer. Within the short period that Mr. Sessions has been travelling he has seen potteries and cotton mills built up in France, Italy, Holland, Germany, India, America and other countries, with such high walls of tariff against the English producer that this country cannot hope to retain these markets with English goods. While these countries can send their productions into this country without any bar whatever, the English China Clay producers have to follow up these foreign factories and obtain just whatever orders the domestic competition leaves for them.

English consumption is gradually declining. Some of our own paper mills are in a deplorable financial condition, whilst many others are in the hands of the Receiver. Foreign paper is simply swamping the English market.

Generally speaking, the year 1924 may be distinguished by an increase in China Clay requirements the world over, but we cannot look for any sustained prosperity in the China Clay industry until English trade is in a better position to compete as a whole with the foreign competition, and the English Government, as other Governments do, gives support to our own manufacturers.

With regard to the progress of English China Clays, Ltd., Mr. Sessions said that they had developed their higher purified clays, or what is called the Colloidal Clay. This clay may be more largely used in the future for medical and other purposes. It has been proved beyond doubt that this high-grade clay possesses remarkable power of absorbing certain poisons, and as far back as 1900 a similar clay was used during the Balkan epidemic of Asiatic cholera, by Kulme, who stated that the cases treated reduced the mortality from 60 to 3 per cent.

Throughout their mines English China Clays, Ltd., are extending and improving filter presses, which have given great satisfaction in drying more cheaply as well as in larger quantities within a prescribed time. It was gratifying to learn that English China Clays, Ltd., had apportioned between £40,000 and £50,000 over the present year for various developments, including drys, pipe lines, and mechanical plant, which should contribute very largely to employment in the district.

With regard to the New Jetty at Fowey, which Mr. Sessions visited on the opening day, he said it was now working fairly well. Considerable delays were experienced through insufficient siding accommodation to deal with the number of trucks.

The whole system of loading and control was very inadequate, was Mr. Sessions' impression of Fowey shipping.

A shipping port such as Fowey with a yearly export trade of over 600,000 tons ought at least to have a telephonic system from each jetty to the station master's office.

Where the jetties are so far apart it seems incredible that foot messengers have to be sent with urgent inquiries and instructions. The producers recognise the importance of telephonic communication and have made themselves responsible for one unit of installation, but it should be the duty of the Great Western Railway to adopt a thorough and complete system throughout the port.

Mr. John Lovering

In reply to your enquiry asking me to express my opinion with regard to the China Clay industry's prospects for 1924, I find it very difficult to venture an opinion as to the immediate future, because, as far as the experience of my own firm goes, 1923 has been no improvement on 1922, rather the contrary.

Figures are not yet available as to the total sales or deliveries of China Clay for 1923, and it is therefore impossible, until those figures are available, to know the actual volume of trade for last year.

I should suppose, from my firm's own experience, that there has been rather a falling off in trade than otherwise. I certainly should be much surprised to find that there was any actual improvement.

I see from time to time in the public press very rosy and optimistic reports regarding the China Clay industry, but to me they are most misleading, for at the present time the various China Clay works of Devon and Cornwall are in a position, if there was only the demand, to produce, sell and deliver, double the quantity of clay as is at present sent away from the works, and if such an over-production took place and led to the cutting of prices (which would be the probable result), then China Clay would be produced only at an absolute loss, and only those firms who have ample reserves would exist.

The Uses of Kaolin in Pharmaceutical Chemistry

Varieties of kaolin specially prepared are utilised as toilet powders. Being absorbent they prevent irritation due to friction. Kaolin is also employed, owing to its absorbing capacity, in making pills, especially with readily reduced or oxidised substances, such as phosphorus pills. In the form of kaolin mass—

Kaolin, fine powder	4 oz.
Soft paraffin, white	8 ,,
Hard paraffin	4 ,,

It is employed for pills of potassium, silver nitrate, silver oxide, permanganate and other similar materials, which the ordinary pill excipients would reduce by contact with organic matter.

In a number of carbolic and other disinfecting powders kaolin forms a silicate base. It is also employed for a poultice to replace linseed or bread poultices. Syrups and cloudy solutions of volatile oils are also clarified with kaolin.

The kaolin mass for pills is prepared by melting the hard and soft paraffins, adding the kaolin and stirring until cool.

Kaolin Ointment.

Kaolin	1 oz.
Soft white paraffin	1 ,,
Hard paraffin	1 ,,

Melt the paraffins together, add the kaolin and stir until cold.

Kaolin Poultice.

Kaolin	577 drachms
Boric acid	45 ,,
Thymol	½ ,,
Methyl salicylate	2 ,,
Oil of peppermint	½ ,,
Glycerine	375 drachms

The kaolin is heated in a suitable vessel at 100°C., stirring occasionally, during one hour. Then the boric acid is blended with it, and the glycerine closely incorporated with the mixture. Finally the thymol is added, previously dissolved in the methyl salicylate, and the oil of peppermint, all being made into a homogeneous mass. It must be kept in an air-tight receptacle.

Kaolin Ointment.

Kaolin	6½ drachms
Glycerine	½ oz.
Acetic acid	3 drachms

This is made into a paste and applied to the skin at bedtime. This is not suitable when the comendoes are inflamed; it is too irritating. But it is an excellent stimulant.

China Clay 1924 Outlook

By S. P. B.

WHILE 1923 has ended without recovering the high water mark of prosperity which it achieved in the " boom " year of 1920, as the total figures for the year on another page show, it was considerably in excess of 1922, itself a year of remarkable recovery after the slump of 1921. The chief factor which prevented a greater volume being achieved in 1923 was undoubtedly the disturbance of continental business caused by the crisis on the Ruhr in January. At that time there were signs of a revival in most of the European countries, including Germany, which country in 1922 recorded the biggest volume of China Clay business since the War. Following the French occupation of the Ruhr, an immediate effect was seen in the falling off of orders from Central Europe, where the demand for China Clay has been of a negligible character since, the situation having also had a detrimental effect on the demands from the countries adjacent to and influenced by the reparations crisis on the Ruhr.

The uncertain political position in Russia has also operated very detrimentally to the development of China Clay business with that country, which before the War took something like 40,000 tons of China Clay per annum, while her neighbour, Germany, took between 80 and 90 thousand tons. The quantities that have been taken by Russia during 1923 have been very small, the chief demand from that part of Europe having been from the new States of Finland, Latvia and Esthonia. With the recovery of the very large pre-War volume of trade with Central Europe during 1924, it is expected that the industry's export trade will reach, if not exceed, the best pre-War total of over 600,000 tons export. The unstable exchanges of European countries have been a source of great concern to the China Clay producers, and has been one of the biggest obstacles with which they have had to contend in their endeavour to recover and develop their European markets. Belgium and the Scandinavian countries have shown the best recovery in Northern Europe, while the increasing demands of Spain have revealed the possibility of expanding markets in Southern Europe. The recovery of the trade with Italy, though as yet not considerable, has indicated the possibility of restoring markets in that country when it has thoroughly settled down to the new régime.

The most encouraging feature of the overseas trade during 1923 was the maintenance of the demand from American buyers, who, despite having to contend with the increased tariff which was put on at the beginning of the year, have been successful in maintaining their markets with English China Clay producers, especially in American paper-mills. This is all the more satisfactory on account of the fact that in recent years the Geological department of the United States Government have been investigating the possibilities of extending the production of kaolins, the development of which has been growing since the War. The deposits of kaolins in America are mainly in the south of the States, somewhat remote from the great manufacturing areas, which factor has handicapped the producers in ousting English clays from American markets on account of the cost of rail transport. Undoubtedly, manufacturers adjacent to the kaolin mines have turned their attention and are using American kaolins to a considerable extent, and, while these kaolins have been found to be suitable for certain purposes, they leave a great deal to be desired as regards constituent qualities compared with English China Clays. Certainly in the markets which mainly use the best qualities of English China Clay for paper coating purposes, the demand is being maintained and cultivated. English China Clay producers are watching the development of China Clay production in America very closely, and are optimistic enough to believe that with the tremendous increase in the demand for China Clay for various purposes, especially in papermaking, the volume of trade that has characterised the China Clay business with America in the last few years is not likely to fall off but rather to have the tendency to increase. It is recognised by American paper-makers that they have nothing in their country to compare with the best China Clays which are imported from England.

As with the overseas markets, the home markets are capable of considerable expansion, though, on the whole, 1923 was a very good year. From the chemical trades and the paper mills the demands have been fairly good, but those from the potteries and cotton mills have been somewhat irregular and comparatively small, this being especially the case with the cotton mills. It is hoped during the current year that the potteries and cotton mills will resume somewhat of their pre-War prosperity, which must lead to a considerably enhanced demand for China Clay.

With regard to the demand from the paper mills, owing to the conservatism of home paper mills and their apparent indisposition to adapt their machines for the production of the cheaper classes of paper, their demands are chiefly for the better qualities of China Clay.

The common complaint on the part of British paper-makers as regards foreign competition is that they undercut the home markets with the cheaper classes of paper. It might be worth their while to consider this aspect of the paper-making business in its bearing upon the use of the cheaper grades of China Clay. When the proposition has been placed before the home paper mills to use cheaper clays for the production of cheap paper their reply has generally been that such clays injure their machines. Yet it is a fact worth consideration that Continental paper mills, which are turning out these cheap papers, themselves use considerable quantities of the cheaper grades of China Clay exported from Cornwall and Devon in their manufacture. They are using some of the cheapest grades of China Clay for this line of business, and, that being the case, it should not be beyond the ingenuity of our home paper mills to adapt their machines, or introduce new plant, by means of which these cheap clays could be used in the production of the cheap papers, which must seriously compete with the products of our home paper mills. If our home paper mills were to place themselves in a position to use some of our cheaper grades of clay, as Continental paper-makers are doing, it would give an impetus to the cheap clay market, which would to some extent compensate for the partial loss of the cheap China Clay market in America, where the production of the cheaper grades of domestic kaolins have effected the English China Clay market.

British Malaya

THE China Clay works at Sungei Perpat are being enlarged with the object of attaining an output of 600 tons per month. Work is to be restricted to the manufacture of latex cups and tiles, and a Japanese expert in pottery has been engaged to supervise the production of these articles.

Employment of Kaolin in Hydrogenation of Oils

THE combination of hydrogen and oxygen is promoted by the presence of China Clay at temperatures of and above 230° C. In the absence of China Clay this combination does not occur until a temperature of 350° C. or greater is attained. The activity of the clay largely depends upon the temperature to which it was previously subjected in heating and the amount of water of constitution which it has lost. The less the percentage of water the less the activity. China Clay in a finely divided state can adsorb colloidal metals, forming bodies which can be utilised as catalysts, medicinal powders, etc. The substance which is to be used as adsorbent may be placed in water in a state of suspension, or in some other liquid, a metallic salt solution being added and precipitation of the metal effected by reduction.

Horse-drawn Wagons

THE China Clay carriers in the St. Austell district have been exceptionally busy throughout the Christmas and early part of the New Year. In November month many a clay carrier was rather pessimistic lest the advent of the heavy transport motor lorries would squeeze them out of their profession. For some weeks past these familar heavy-ladened wagon-loads of white clay have been passing through the town en route to the station at St. Austell or to the Port of Charlestown.

There are several motor lorries engaged in carrying China Clay, but the roads to some of the clay works are only accessible to horse-drawn wagons, and it will be some time before modern locomotion eliminates this very old allied industry.

The Breaking Down of China Clay for Papermaking

By Sheldon Leicester

WHERE China Clay is used for making common papers, such as wrappings, the clay is often put straight into the beating engines, the beater roll breaking up the lumps and mixing same with the fibrous mass.

For finer papers, however, the reduction to fine particles must necessarily take place in special apparatus, as it must be strained through fine wire gauze screens, before being added to the pulp, to eliminate all impurities and sand, which readily manifest themselves in the finished sheet of paper.

This grit on the paper machine also frequently causes trouble by becoming detached from the paper and sticking to and scratching the press rolls and cylinders, where it is held by doctor blades which are provided for keeping them clean. If it remains in paper which is used for printing with half tone blocks it frequently causes wear on the soft copper surfaces and the papermaker risks a complaint if not an actual claim.

The machines used for breaking down the clay with water are usually quite simple forms of agitators, with either

CHINA CLAY DISSOLVER

horizontal or vertical revolving shafts with arms, working in tanks, from whence it is carried in buckets or run off in pipes to the beaters, the clay being screened before entering. Other methods include stone ball mills, where the clay is ground up in revolving perforated metal drums with stone balls, the reduced clay passing through the perforations into the container. Other machines of the coffee mill type have been used also, but there would seem to be room for some more efficient method, especially as when mixed with water there is some difficulty in controlling the exact amount of clay used for each engine and regulating the correct percentage in the paper.

The Niethammer Clay Dissolver shown in the illustration is a machine built on the Hoythollander principle by J. M. Voith, of Heidenheim, and claims the advantage that it is charged with the exact quantity required for each beater and therefore provides a constant percentage in the paper.

The weighed charge is filled in through the hopper, after a sufficient supply of water has been run in, and the beater roll, which is provided with paddles, either belt or motor driven, is set in motion. The clay is beaten up very fine so that it will pass the finest sieves, and grit and fibres from the sacks, etc., are easily eliminated. The operation is very quickly effected and no extra labour is required. The charge when ready is piped direct to the beaters.

The machines are made in two sizes with a capacity of 300 and 600 lbs. respectively.

[NOTE BY EDITOR.—Since the above article was written by Mr. Sheldon Leicester he has patented a new combined beater and refiner, which has some novel features of interest to papermakers, as provision is made for the development of speed and closer consideration of the influence of stuff consistency and temperature in the beating process. No arrangments have yet been made, we understand, to make the machine, but the inventor would be glad to hear from papermakers' engineers.]

Transport of China Clay to the Potteries

IN looking through a China Clay publication of 1914 we found the following list, which gives the then current prices for China Clay of various grades and which shows the price delivered at the nearest storage point to the Potteries.

	Delivery at.	Per ton. s.	d.
China Clay, snow white	Etruria	56	0
China Clay	Warehouse, Runcorn	56	0
China Clay, for cargoes	f.o.b. Cornwall	35	0
China Clay, extra white, suitable for high temperatures	Etruria	54	6
China Clay, extra white, suitable for high temperatures	Warehouse, Runcorn	44	6
China Clay, extra white, suitable for high temperatures	f.o.b. Cornwall	33	6
China Clay, special white	Etruria	49	0
China Clay	Warehouse, Runcorn	39	0
China Clay, for cargoes	f.o.b. Cornwall	28	0
China Clay, vitreous white, for glazed bricks	Etruria	48	0
China Clay, vitreous white, for glazed bricks	Warehouse, Runcorn	38	0
China Clay, vitreous white, for glazed bricks	f.o.b. Cornwall	27	0
China Clay, superior potting	Etruria	46	0
China Clay	Warehouse, Runcorn	36	0
China Clay, for cargoes	f.o.b. Cornwall	23	6
		Per cwt.	
China Clay, best potting	Etruria	4	0
		Per ton	
China Clay, best potting, under 2 tons	Etruria	43	0
China Clay, best potting, over 2 tons	Etruria	41	0
China Clay, best potting, under 4 tons	Warehouse, Runcorn	31	0
China Clay, best potting, over 4 tons	Warehouse, Runcorn	30	0
China Clay, best, for cargoes	f.o.b. Cornwall	23	0
China Clay, white	Etruria	41	0
China Clay, white	Warehouse, Runcorn	31	0
China Clay, white, for cargoes	f.o.b. Cornwall	21	0
China Clay, ordinary good potting	Etruria	38	0
China Clay	Warehouse, Runcorn	28	0
China Clay, for cargoes	f.o.b. Cornwall	17	0
		Per cwt.	
China Clay, dried and sifted	Etruria	6	0
		Per ton.	
China Clay, dried and sifted	Etruria	61	0

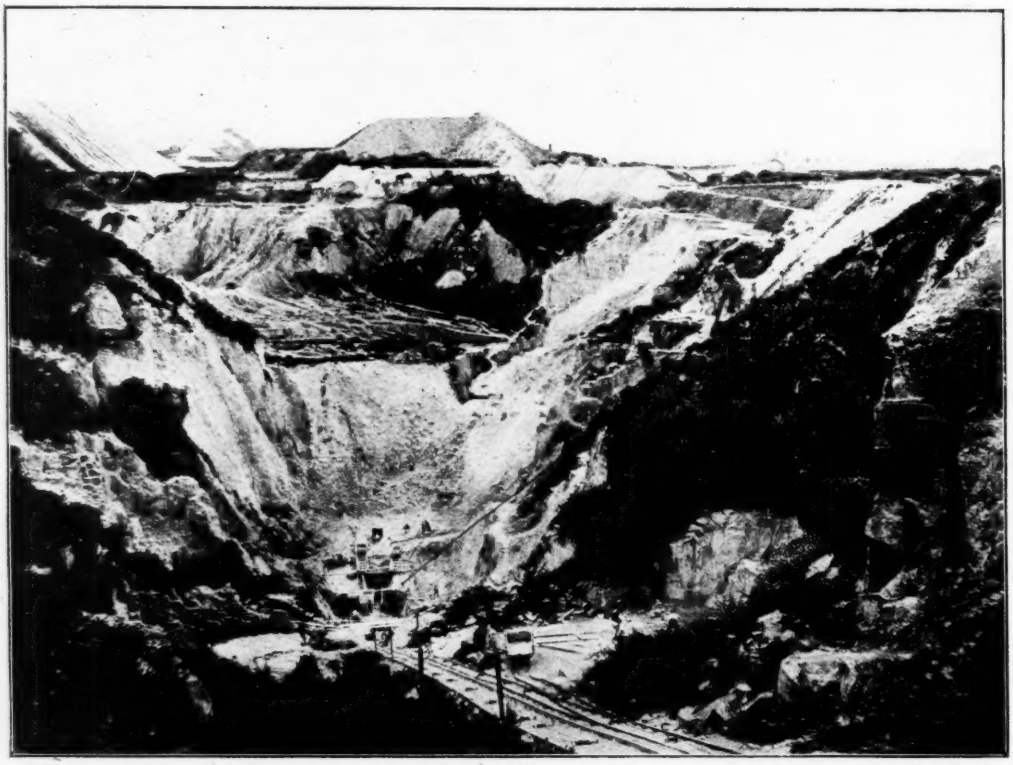
This makes curious reading compared with the present-day prices. Before the great World War, which changed so many of our ideas with regard to prices and transport, China Clay used to be delivered to the Potteries almost entirely by sea and canal at a cost of little more than half of the then existing railway rate, but with the advent of the War and the lack of and danger to ships, sea freights rose to an almost prohibitory height, and the only other means of transport was then by railway. To-day the railways have grasped the importance of this transport business to the Potteries and the competition between the two routes is very keen, so much so that the railways have now a special rate in operation to compete with the sea and canal transport, in spite of the fact that sea freights are now less than double pre-war level.

Water Route

China Clay is railed from the various works, principally to Fowey or Par, for shipment, from thence it is shipped to Runcorn or Weston point, both of which are in close proximity to the Potteries. The clay is carried from Fowey to Runcorn by sailing vessels and coasting steamers, the former taking usually 150 to 250 tons and the latter 450 to 500 tons. Runcorn is on the Mersey, and is about 20 miles inland from the Liverpool landing stage, the distance from Fowey to Runcorn being 345 miles. The clay is then unloaded at Runcorn, and stored under cover by the Manchester Ship Canal Co. Here steamers conveying up to 1,000 tons can be handled, and there is storage capacity, under cover, for 40,000 tons. From the Runcorn stores the clay is then loaded into canal barges carrying about 20 tons each, and is brought up to the local pottery canal wharves for delivery to the various factories, which is drawn by the canal carriers' wagons or the manufacturers' private carts. Quite a number of the Potteries are alongside the canal, in which cases the clay is discharged direct to the respective works, thus obviating carting charges.

(Continued on page 14)

ENGLISH CHINA CLAYS, Ltd. BURGOTHA CLAY WORKS, near Meledor, which was opened just before the war, is celebrated for its potting and bleaching clay.



ENGLISH CHINA CLAYS, Ltd. LITTLE TREVISCOE CLAY WORKS, St. Stephens, Cornwall. Best potting clay.

(*Continued from page* 11)

The cost of conveying the clay from the clay works to the port of shipment, freight to Runcorn, and landing charges and canal rate to the pottery wharves or water-side factories is to-day about 29s. per ton, and to this has to be added the carting charges from the local wharves which vary according to the distance, but on an average would be about 3s. per ton. The 29s. previously mentioned is based on what we might call a winter sea freight, but in summer-time this would, in all probability, be reduced by about 2s. per ton.

Rail Transport

By direct rail the clay is loaded at the clay works in trucks, carrying any weight desired between 4 and 12 tons, and here we have two routes in competition—the G.W. Rly. and L.M. & S. The former carry to Market Drayton, about 16 miles from the Potteries, and then hand over to the L.M. & S. who complete the journey. If consigned by the L.M. & S. they take charge of the trucks at Bushbury, about 32 miles from the Potteries, and bring forward via Norton Bridge. The railway rate, by whichever route consigned, is exactly the same, which is 26s. 10d. per ton to all pottery stations, but in this case also must be added the carting charges which will be the same as mentioned per canal.

The distance by direct rail to Stoke-on-Trent is 322 miles, to which, of course, must be added two or five miles according to the situation of the respective pottery towns.

A certain quantity of the clay for the Potteries is railed in Devon, in which case the railway rate is 25s. 2d. per ton, and the sea freight from here is about the same as from Cornwall.

It will be seen from above-mentioned charges for transit that there is very little difference between the cost of sea and canal and rail.

Readers of THE REVIEW will have noticed from our monthly totals how much more clay has been consigned by rail recently than in the past, this, of course, being due to the efforts now being made by the railway company to compete with the sea-borne traffic.

China Clay Prices

Small Margin of Profit

A very informative and interesting article recently appeared in "Chemistry and Industry," by Mr. H. F. Collins, A.R.S.M., M.I.M.M.

REFERRING to "Output and Profits," Mr. Collins says:—During the 20 years before the war the output of China Clay had shown a fairly steady increase, from 425,000 tons in 1895 to 860,000 tons in 1912 and 1913, whilst during the first half of 1914 the sales amounted to 500,000 tons, or at the rate of one million tons per annum. Of this total between 75 and 80 per cent. was exported to foreign countries, the chief individual consumer being the United States, with a consumption which had risen steadily from 65,000 tons in 1895 to 335,000 tons in 1914. The war, with its scarcity of tonnage and high freight rates, cut down the export trade to very small dimensions, foreign countries being thus forced to develop to the utmost their native sources of supply, which are in many cases abundant, though generally of inferior quality. In view of this development of native supplies, it seems doubtful whether exports to the United States will ever again reach the high-water mark of the years just before the war.

After the war there was a rapid increase in exports, mainly with a view to replenishing vanished stocks abroad, but this was followed by a slump, from the effects of which the industry is only now recovering. Really accurate figures in regard to output, sales and export are not obtainable, the Government statistics in regard to export in particular being most misleading, since ball clay and lump and ground china stone are all included with China Clay in one general total without distinction, a fact which renders these statistics absolutely useless to those interested in the industry.

As regards actual deliveries during the past three years, information furnished confidentially to the writer leads him to put forward the following figures, which he believes will be found to be close approximations to the truth, viz.:—

	Tons.
1920	770,000
1921	370,000
1922	670,000

Seeing that the actual output for the first half of 1914 was at the rate of one million tons per annum, the above figures show that, in spite of the recovery in 1922 from the depression of 1921, which certainly represents a real improvement, the output of to-day is still far short of that of the pre-war period. This, however, does not tell the whole story. During 1914 many extensions of drying plants were in course of erection, and a good many new ones have been completed since, so that the total productive capacity of the industry, as measured by drying capacity (the accepted standard), must be at the present time very nearly 1¼ million tons per annum. Owing, therefore, to the limited demand, the actual output of China Clay is still only about 55 per cent. of the total productive capacity of the existing plants. In view of the many misleading statements recently published in regard to the great improvement in the trade and its prosperous condition, it seems desirable to draw attention to the undoubted fact that the plant and equipment at present employed in the industry is far from being fully utilised.

As to prices and profits, the principal controlling interests seem to have realised that the only hope of regaining the markets lost during the war period is to reduce the selling prices to the lowest point possible. The present selling prices, however, are still so far in excess of the pre-war prices (at which good profits were made) that some have jumped to the conclusion that producers must still be making large profits. This is by no means the case at present, for the costs of production have increased at a greater ratio than have the selling prices.

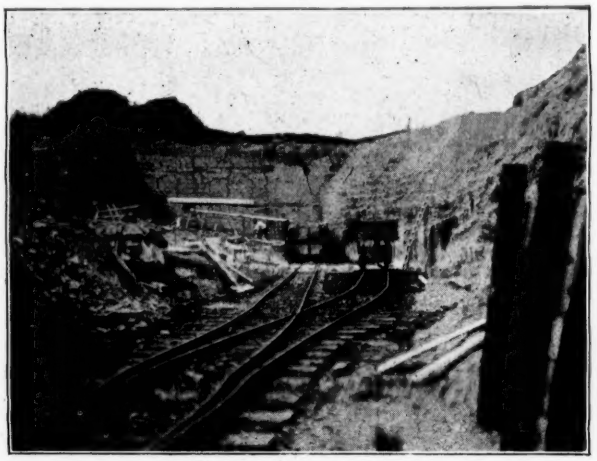
In the first place, comparing the year 1921, for instance, with 1914, the standing charges at a clay works remain at about the same level whatever the output. Salaries of officials, and the cost of maintaining the shafts, levels, pumps and other plant suffer little or no reduction even if the works stand idle all the year. The surface and coming spring water has to be pumped in any case, and considerable expense is often caused in an idle pit through slipping in of material from the sides. All these costs are on a much higher basis than in 1914, perhaps on the aggregate nearly double, and upon one-half or less of the full capacity the aggregate cost of these standing charges per ton of clay produced and sold is nearly four times as great. Minimum rents are in some cases so high that they only merge in the royalty when the pit is being worked at more than half the full capacity. Local rates, too, have gone up enormously.

As regards operating costs proper, all are much higher absolutely, apart from any question of working at below full capacity. Coal for pumping and for drying, which forms a considerable proportion of the total operating cost, although coming down in price, is still much dearer than in the pre-war period; its average price during the years 1921–1922 may be taken at about double that of the pre-war period 1913-1914. Even a greater discrepancy is to be noted in regard to the wages part of production cost, although not all of this is apparent. Not only does the current rate of wages paid in the industry rule higher than in the pre-war period, but there is some falling off in efficiency. Up to 1916 the district had been characterised by its free labour. About that time (entirely through the agitation of organisers from outside, who were paid agents of a trades union anxious to increase its membership and its political influence) branch unions were started in the district, and soon the whole of the workers became members of the union in question. The usual consequence followed (although, as usual, stoutly denied by the union officials and sympathisers), namely, that efficiency, or the work done per man, showed a serious falling off. The union has ceased to have any influence in the district as an active factor in the labour problem, but the falling off caused by its former influence has not yet been completely made good.

Upon the whole, therefore, as a consequence of all the various reasons enumerated, the rise in working costs has kept far ahead of that in selling prices, as compared with the pre-war period; and the margin for profits in the industry will remain somewhat small until the condition of the world, and particularly of Central Europe, approaches more closely to normality, and until output begins to catch up productive capacity.

Among the Ball Clay Mines of Dorsetshire

We are delighted to give our readers an introduction to the Ball Clay mines of Dorsetshire in our first issue of the New Year. According to the history and traditions of this industry it has certainly revealed more romance than even some of the China Clay mines further west, and demonstrated beyond dispute that the clays found in these mines were used by those ancient Britons ages before the potter's wheel came into use. Through the courtesy of Messrs. Pike Brothers we are enabled to refer to one of the oldest and largest of the Ball Clay-producing firms in that remarkable county. The business of this firm has been continuous since 1770 and under the control of the Pike family. In a statement read at the annual meeting of the Ceramic Society at Bournemouth last year, the output of Ball Clay from Dorset in 1919 amounted to 72,378 tons, which shows that a good trade is being done in Ball Clay in that district. From relics of the past which have been unearthed from time to time in the development of these mines, it has disclosed beyond doubt that Ball Clay mining and manufacture was one of the pursuits of the Ancient Britons. From at least one record of an "Order in Council," in the year 1666, arising out of a dispute between Wareham and Poole, it was directed that no dues were to be paid upon clay utilised in the manufacture of those white clay pipes which were so universally used by smokers at that time, which was regarded as a big concession. According to the "History of Dorsetshire," published in 1774, it is recorded that Ball Clay was the chief article sent from the "Key at Wareham."



Dorset Ball Clay Pit.

In the present workings vases and cinerary urns made of local clay have been unearthed, which justify the historian in the belief that the Romans must have followed the pursuits of the potter in that very early and crude period.

The clay is worked in open pits, as shown in our illustration No. 1, to a depth of about 40 ft. These pits, unlike the China Clay mines, do not lend themselves to photography, but these very interesting "snaps" reveal an enormous deposit of the clay of the very best grades. From this mine is derived a very refractory plastic clay, and an excellent binder, used in many countries for high-tension insulators and quite a variety of refractory goods.

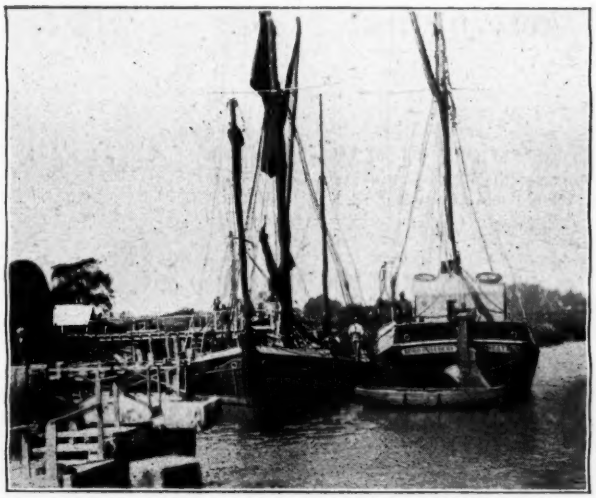
The K clay used by the earthenware manufacturers all over the world is an earlier deposit found some 50 ft. deeper. This has to be mined; both vertical shafts and, where possible, level adits are necessary to get at the clay. Although our illustrations may not interest the uninitiated consumers can form some idea as to the process of production of the clay as extensively employed in the manufacture of so many useful domestic necessities. In the United States the properties of the Dorset clays have been recognised by the scientific authorities of the Department of Commerce as being quite distinguished from those of Devon, and superior to the American clays for use in ceramic bodies. The Dorset clays are highest in drying shrinkage and contain a moderate amount of matter requiring oxidation. Unlike the American clay, the Dorset clays vitrify at a low temperature, cone 01 to cone 6, and remain constant in volume and porosity through a wide range in temperature. The difference in the burning behaviour is the

Pond where Ball Clay Once Stood.

main reason why the substitution of American clays with the American potters have not been more successful.

When the clay is mined it is matured by resting, or, as it is locally named, "weathering," and for this purpose it is spread over in long tips, ten or twelve feet high, according to our illustrations. After lying for twelve months in the open, it is dug over, so that the bottom comes to the top. When it is ready for shipment it is loaded into wagons, and some of it is consigned direct by rail to the Potteries or to the waiting barges at Pike's Wharf at Ridge, near Wareham, as so pleasingly portrayed by our illustration No. 3, or to the firm's lighters to be towed to Poole for loading into vessels which are too large to come up the river. The area of Messrs. Pike Brothers in Dorsetshire is very extensive, and the process of production requires a big acreage in order to accommodate the dumps of clay for a period which is absolutely necessary for its completeness and readiness for use.

Our illustration No. 1 shows an open pit. The underground workings are most interesting, and are almost identical with Cornish tin mining. Some of these pits are as deep as 200 feet, and at the bottom the clay is penetrated in all directions by tunnels driven from the main shaft. These tunnels vary in size but sufficient for all the men to use a tram-wagon



Loading Ball Clay at Wareham, near Poole.

to dig out and convey the clay to the main shaft, from whence it is raised to the surface by a steam winding plant.

Mr. Pike informs us that the Ball Clay producer in Dorsetshire is frequently blamed for the spoliation of the countryside, but he contends that the damage is only temporary, and a disused claypit is not such an unpicturesque sight as some critics would have it. Our second illustration shows what was once a Ball Clay pit and is now a deepish pond with 20 feet cliffs around it. It is said of this particular pit that its earliest operation involved the destruction of Ashen-Barrow—a barrow or a mound said to have contained the remains of the King of Iceni, ruler of the ancient Britons, and a vase very crudely made of the same clay full of cinerated bones and an amber bead. Fortunately, the district is favoured by nature in the provision of waterways as well as railway sidings for the despatch of their product. The borough town of Wareham is near the mouth of the River Frome, and there is another navigable river flowing on the north side of the town and enters Poole harbour close to the embouchure of the Frome. The harbour at Poole is considered to be one of the best in the English Channel for big merchant ships, which does a large business in the export of clays from this district to the Baltic, Norway, Portugal and America. The industry gives healthy employment to quite a number of men, and the developments which have taken place in latter years show that the best traditions of this old-established firm have been more than fulfilled, and the prospects for the industry and for the firm were never more encouraging than at the present time.

Paper Mill Advertising

We recently came across a clever Advertising Sheet sent out by an old established Paper Mill at Boston, Massachusetts, U.S.A.

The sheet broadcasted was to advertise a 60 lb. white wove Flemish book paper and the front page, printed in blue and black inks had nothing more on it than that :—" The following page is taken from the Town report of a Massachusetts town in the year 1852—proving that Town reports were not always as dry as dust."

The second page of the sheet, we print in full, including the auditors' note at the bottom :—

TOWN AGENCY FOR SALE OF ALCOHOLIC MEDICINES, INSTITUTED UNDER THE ACT OF MAY 22d, 1852.

Paid E. Preston & Co., for 1 Bbl. N. E. Rum, 37 galls. at 28c,	10 36	
for one eighth Cask, A. Scinett Cog. Brandy, at $1,65, 20 1-2 galls.	33 82	
for 10 Galls, 85 per c. Alcohol, at 52,—Keg 87,	6 07	
for 10 galls. (pine apple) Holland Gin, at 95,—Keg 87,	10 37	
for 2 galls. St. Cx. Rum, at 1, Demj. 50,	2 50	
for 2 galls. Sicily Wine, at 95, Demj. 50,	2 40	
for 2 galls. Port Wine, at 1.50, Demj. 50,	3 50	
for 2 galls. Brown Sherry Wine at 1,38, Demj. 50,	3 26	
		$72 28
Stacy and Currill, for Carting same,		1 00
D. M. Swift,—for 4 months service, as Agent for Town for the Sale of Alcoholic Medicines,		26 67
Whole Expense,		$99 95
CONTRA.	CR.	
Received from D. M. Swift, Town Agent, amount of proceeds of Sales from the Agency,		$64 23
Stock on hand,		$35 72
Amount of Sales, 4 months,	64 23	
Agent's Salary 4 do.,	26 67	
Balance, Sales,		$37 56

The Auditors hope they may be pardoned, if they just hint, very delicately, that should the Town Officers at any time feel unwell, they might be allowed to obtain their remedies from the Town's stock of medicines.

The original " Town report " was, of course, printed before the Volstead Act, but now that the pros and cons of Prohibition are being so fully discussed in U.S.A., such a report cannot help raising a smile and arresting the reader's attention.

Bibliography of Works on China Clay in Patent Office Library

COCK, D. Nature, Production and Uses of China Clay. London : 1880. Sm. 8vo.

COMPTON, T. WM. COOKWORTHY (Discoverer of English China Clay, Chemist and Potter). London : 1895. Sm. 8vo. 144 pp. Portrait.

MUSEUM OF PRACTICAL GEOLOGY. A handbook to the collection of Kaolin, China Clay, and China stone in the Museum. By J. A. Howe, with appendix by A. B. Dick. London : 1914. 8vo., 280 pp. 9 plates.

SPRAT, J. E. Refining and Utilisation of Georgia Kaolins. 60 pp. 5 plates. U.S. Department of the Interior (Bureau of Mines). Bulletin 128. 1909.

WATTS, A. S. The Felspars of the New England and Appalachian States. 192 pp. 8 plates. U.S. Department of the Interior (Bureau of Mines). Bulletin 92. 1909.

WATTS, A. S. Mining and Treatment of Feldspar and Kaolin in the Southern Appalachian Region. 170 pp. 16 plates, map. U.S. Department of the Interior (Bureau of Mines). Bulletin 53. 1909.

French

DUCOURTIEUX, P. Le premier gisement de Kaolin en France (Réponse à E. Labadie). Limoges : 8vo, 22 pp. 1912.

LABADIE, E. Le Pharmacien Bordelais M. H. Vilaris et la découverte du premier gisement de Kaolin en France (1766–1768). 8vo, 44 pp. Portrait. Bordeaux. 1907.

German

RÖSLER, H. Beitrage zur Kenntniss einiger Kaolinlagerstätten. Neues Jahrbuch für Mineralogie, etc. Beilage-Band 15. pp. 231–393. 1903.

STAHL, A. Die Verbreitung der Kaolinlagerstätten in Deutschland. 144 pp. Map. Archiv. für Lagerstätten. Heft, 12. 1910.

Current Literature

China Clay in California
Brick and Clay

Mining Kaolin in Delaware. C. H. Thomas.
Engineering and Mining Journal, May 26, 1923.

Preliminary Report on the Residual Kaolin and Feldspar in the Pacific Northwest. By H. Wilson, A. L. Bennett, and F. T. Heath. Map.
Journal of the American Ceramic Society. March, 1923.

Use of Sedimentary Kaolins of Georgia in white wares. G. A. Bole and R. T. Stull.
Journal of the American Ceramic Society. July, 1923.

Effect of Hydrogen Ion Concentration upon Clay Suspension (American Kaolin and English China Clay, etc.). By Hall.
Journal of the American Ceramic Society. September, 1923.

The Effect of Variation in Firing on the Physical Properties of Vitreous China Bodies. Sortwell.
Journal of the American Ceramic Society. August, 1923.

The Properties of some Clay-like Materials of the Bentonite Type. Schurecht and Douda.
Journal of the American Ceramic Society. August, 1923

New China Clay Company

THE Imperial Goonbarrow China Clay Works at Bugle, which have been under the proprietorship of Mr. J. H. Knight, of Par, for many years, have just been acquired by Mr. S. J. Dyer and Mr. J. Venning, of St. Austell, and will soon be developed by a new private company.

The Imperial Goonbarrow is one of the famous Goonbarrow Mines of the Bugle district, with a present output of 10,000 tons per annum. Mr. S. J. Dyer, who is the managing director of the Rosevear China Clay Co., Great Treviscoe China Clay Co., and other China Clay mining companies, has informed our St. Austell representative that the works were purchased on December 27, and within a fortnight found sufficient capital among their own friends to carry on without issuing a prospectus. Mr. Dyer said the Goonbarrow Clay has a great reputation amongst the best users, and the new company intend to develop this mine to its fullest extent. This transaction should be very gratifying to those associated with the industry, as it serves to illustrate the return of the clay trade to a more prosperous activity and emphasises the confidence that local people entertains for the industry by subscribing plenty of capital for the prosecution and development of the mine.

China Clay Notes and News

China Clay for Stereotyping Matrices

Very special care is necessary, says *La Papeterie* of November 10, in making flongs for stereotyping. The material is made from paper cuttings not containing wood pulp and 20 per cent. China Clay free from sand. Resin and good quality aluminium sulphate are employed as size.

The round machine on which this is made must be constructed so as to ensure as little loss of fibre and loading as possible. It must have a rotary strainer with a drum in which the openings are small enough to retain all kinds of lumps. There must also be a spoon wheel to keep the pulp in constant circulation. The wire gauze on the drum should be No. 80 and sometimes 100. To obtain a perfect product the wet press must be covered with a very pliant coat, without marks, ½ in. or so thick.

When the sheets leave the machine they should be laid one on the other, so that the glazed sides will touch. Each sheet must be examined to see that it is free from knots and rubbed with talc powder. Some years ago this material was only made on round machines, but latterly mill-board machines, and in some cases flat machines, have been used.

At the present time machines with four drums are largely adopted, the three first containing white pulp and the last brown. The round machine has great advantages, as the four sides of the sheet are automatically cut. Flat machines must be perfect in construction, with two good presses to remove water, and even a pressure roll on cloth and the dryer must be very powerful. Application of a second light coat can be made on the flat as well as round machine by employing the "Diana" process, "Olu" cylinder or other suitable methods.

Imitation Porcelain

According to a French invention by the "Art du Papier Co., paper pulp, or paper reduced to a pulp, is finely ground down by some suitable means to as fine a degree as possible. It is then desiccated and crushed to a powder. Casein, suitably diluted with water, is then added as a binder. Casein has the advantage of being imputrescible and not decomposing nor affecting the colours added. A little calcium carbonate is now gradually added while kneading, which absorbs most of the water used with the casein. When this is incorporated, finely-pulverised China Clay is mixed with the material, also kneading.

Thus a very consistent uniform paste is made which can be moulded by compression or stamping. It is white, but can be coloured by adding suitable colours while kneading.

The objects thus made are put into a dryer, where, after a time, the temperature is increased so as to really burn the material, which makes it very hard and gives it the appearance of porcelain, of which it has the delicacy without the fragility. It can be enamelled cold with a collodion or cellulose acetate varnish which, being fluid, will penetrate and harden the surface. Then a second enamel can be applied, containing suitable proportions of crushed white glass in impalpable powder. The aspect is exactly that of porcelain.

This material is very suitable for making dolls, and their heads perfectly resembling porcelain, though not so fragile.

To Remove Iron from China Clay

The methods employed consist in the application of hydrochloric, sulphuric or sulphurous acids. There is, however, the inconvenience of requiring a large quantity of acid which must subsequently be removed from the clay, heating being also necessary. A process invented by F. Schulz is claimed to be more practical. The material is mixed with water and a small quantity of mineral acid added, then a little hydrosulphurous acid or hydrosulphite, all being mixed. For example, 200 parts of water are used for 100 of China Clay, 200 of sodium hydrosulphite, 300 concentrated sulpuric acid, at 66° Baumé, The iron is eliminated almost immediately after adding the hydrosulphurous acid or hydrosulphite. The supernatant liquid can be again utilised without loss, as it is only a very diluted sulphate of iron solution.

China Clay Mixer

The mixer invented by P. Bezieres, a French inventor, consists of a steel half-cylinder in which beaters rotate to push the clay gradually to the exit, from the sand and residue, where there is a sliding door, more or less opened according to the amount of clay to be washed. A strong current of water is run into one end of the mixer, opposite to the exit, which carries away the barbotine to pass out through an overflow above the exit, whilst the residue is carried by the paddles in the lower part to the sliding door to fall into gutters from which it is removed. Both large and small quantities of China Clay can be treated.

It is merely necessary to regulate the door to suit the quantity of China Clay passing through per hour.

St. Austell Freemasons' Worshipful Master—Mr. E. J. Hancock

At the annual installation of the St. Austell Peace and Harmony Lodge of Freemasons, 496, on January 8, Mr. E. J. Hancock, managing director of West Carclaze China Clay Company, and a director of Associated China Clays, Ltd., was installed worshipful master for the ensuing year by the retiring master, W. Bro. T. Warne. Amongst those whom the worshipful master appointed as his senior officers were Bro. W. H. Bettison, who is well-known in the China Clay area as a parish official (Senior Warden), and Bro. George Johnson, who is well known in the China Clay trade as a director of Messrs. Varcoes Clays, Ltd. (Junior Warden).

Oil in Somerset

We understand that the tests which have been made by experts for the extraction of oils from huge deposits of shale between Combwich and Watchet, have been highly successful, and, in view of the oil burning kiln erected last year in one of the China Clay works, this news may be of great interest to the China Clay industry.

It is claimed that the supply of oil-bearing shale in the district is almost inexhaustible, and it is a remarkable fact that the shale burns in a furnace like coal. The average thickness of the belt of shale in West Somerset is about 700 ft., a large proportion standing above the normal surface of the ground in ridges and hills.

A noted mining engineer, who has been making investigations in that area, is of opinion that the shale is capable of yielding something like 200,000,000 tons of oil of the finest quality. An important factor is the cheap power and heat provided by the oil shale fuel and waste gases, it being claimed that the richer seams are equal in calorific value to coal.

G.W.R. and China Clay

The *Great Western Railway Magazine* is, as usual, an interesting number for January. Referring to the many improvements made during the last year, in many parts and branches of their line, they have the following note :—

"The shipments of China Clay at Fowey are steadily rising, and to meet the demands of the larger boats, a new Jetty (No. 8) at Fowey has been opened and is in regular service. A dolphin for facilitating the mooring of large boats at No. 4 Jetty has been authorised, as well as a relief-road truck weighbridge at Goonbarrow Junction, for dealing with the China Clay traffic from that area."

U.S.A. Paper and Pottery Trades

Our latest advice from America, dated January 1, 1923, is as follows :—

"Business is very 'spotty' here and consumers are just buying what they need for immediate use. We should say that coated paper production is only about 40 per cent. of capacity, and book and magazine production about 65 per cent. The pottery business is still holding up very well."

Drying of China Clay

The purpose of an invention by Mr. J. Adair is to accomplish the drying of China Clay by the employment of heated chambers placed at distances apart, the China Clay being located in the spaces between the chambers or the chambers void of the spaces may operate the drying of the clay. The important principles displayed by this invention in the actual drying of the wet China Clay are : First, the storing of the heat in chambers and the locating these chambers in the interior body of the wet clay, and second, the principle of constructing the chamber of a thin material having a speedy heat-conducting power, and employing steam as a heating force therein, also controlling the inflow therein and outflow

therefrom of this steam by the employment of cocks. The invention also comprises means whereby the wet clay is removed from the tanks and conveyed to the chambers and loaded thereon; means whereby the clay when dried is removed from the chambers; and means whereby the moisture in the clay is more speedily evaporated.

Researches on German China Clays

At the fourth meeting of the German Ceramic Society a paper was read by R. Rieke in which he insists upon the importance of a systematic study of German China Clays from the geological, physical, chemical and technical points of view. His researches were made on three points:

(1) Chemical composition, comprising not merely analyses but also washing and the substances dissolved by diluted hydrochloric acid and concentrated sulphuric acid.

(2) The behaviour, from the physical point of view, as also plasticity and burning.

(3) Employment of China Clay for porcelain manufacture. Amongst 27 samples examined, two were found comparable with Zettlitz Kaolin. Most of them contained 80 to 95 per cent. of argillous matter, whilst others were only *débris* from felspar with a percentage of 20 per cent. He drew attention to the necessity of controlling the working of deposits, considering the different results met with in the same deposit.—*La Céramique*, Oct. 1923.

Engineering at the British Empire Exhibition

No doubt many China Clay producers will visit Wembley in 1924 and make a point of seeing the engineering section there.

It is officially stated by the British Engineers' Association that considerably more than 300 of the leading engineering and shipbuilding firms of Great Britain are now pushing forward their arrangements for a joint demonstration of efficiency in the Palace of Engineering at the British Empire Exhibition which is to be opened at Wembley six months hence.

From an inspection of the lay-out of the various sites, now in progress of completion, it is abundantly clear that this important part of the exhibition will be at once the most ambitious and practical effort that has ever been made to acquaint the whole world with the great possibilities for promoting trade and transport inherent in the key industries of the nation.

There will be nothing of the purely ornamental. Directors and heads of departments of the firms concerned are going with infinite care into the preparatory work for putting down plants and machinery, and business men from all over the world, as well as those of our own country, will be able to see for the first time, under one roof, practical and operating examples of the science and workmanship of the nation's greatest engineering shops and shipyards.

The promotion of commerce is the essential keynote. The visitor to Wembley will be able to make inspections which otherwise would involve weeks of travel about the county through the various centres of the engineering industry.

The general organising of the arrangements for the industries of shipbuilding, marine, mechanical and general engineering is being carried out by the British Engineers' Association.

Describing his Section, Mr. D. A. Bremner, O.B.E., Director of the Association, said in an interview:—"It may be asserted without fear of contradiction that this section will contain the finest collection of engineering plant and machinery and materials ever assembled under one roof. All the well known firms will be there, and they are viewing with one another in making their exhibits worthy of their reputation. They will afford demonstrations of the high quality of British workmanship and examples of technical and scientific progress.

"Many new inventions and designs, improvements in every direction will be displayed. A large proportion of the stands will have working exhibits. Electricity, gas, steam and oil will all be in use as power generators for the exhibits. There will be exhibits weighing 150 tons each, and the most delicate testing instruments yet made."

Plants used in the iron and steel productions and in mining will be on a most elaborate scale, and a special feature is being organised to interest visitors from countries developing their own local industries.

It will be of interest to the many hundreds who will be personally associated with the work of the various firms that a very fine Engineering Club is to be erected by the British Engineers' Association.

China Clay in Papermaking

MR. JAMES STRACHAN, F.Inst.P., F.R.M.S. (Donside Paper Co.) gave an interesting lecture last month to the members of the Aberdeen Division of the Technical Section. The meeting was attended by a representative gathering from the local paper mills.

Important Papermaking Auxiliary

Mr. Strachan stated that China Clay was one of the most important auxiliary materials used by the papermaker, but one which did not always receive the attention due to it. The largest deposits of China Clay in the world were in Cornwall and Devon, which was a granite country, very like Aberdeenshire in many respects. He believed that there was one very small deposit of China Clay in Aberdeenshire, but in Cornwall stupendous masses of granite had been transformed into China Clay rock by natural operations which had long been the subject of discussion among geological and mineralogical chemists.

In a former lecture he had described the processes employed to win the clay from the rock; now he proposed to deal with the natural history of the mineral and how it acquired certain colours and impurities.

Formation from Granite

Dealing with the formation of kaolin or China Clay from granite, he exhibited a very fine series of specimens showing in twelve stages the gradual transformation of hard granite into soft virgin clay. The kaolinisation of the felspar crystals was illustrated by large porphyritic crystals. The general consensus of opinion was that this alteration had been produced by the action of heated waters and gases coming from below. This was a very important point, because it indicated the existence of large deposits of the mineral at greater depths than those now reached. In fact, a century's working of clay in Cornwall had only scratched the surface. Clays were valued by the producer in Cornwall very largely by their colour, the whiter the colour the more valuable the clay. This was particularly the case with China Clay for papermaking. He considered that the producer should pay more attention to purity, because he had seen clays containing from 10 to 20 per cent. of impurities in the form of mica and sand priced at higher figures than very much purer clays because the latter were creamy in colour.

Tints in Clay

The commonest tints in clay were yellow, arising from hydrated oxide of iron and from organic matter of a peaty nature, and red, derived also from an oxide of iron. A very high price was commanded by certain clays having a natural bluish tint. By means of selected specimens the lecturer showed that this colour was due to the presence of numerous microscopic crystals of tourmaline, which from the papermaker's point of view was an undesirable and gritty impurity.

Dealing with the mechanical purification of China Clay, and the impurities left in it by imperfect manipulation, Mr. Strachan stated that this could be viewed from two standpoints, viz., those of the producer and of the consumer. Impurities such as mica interfered with the surface of paper for printing of blocks, and sand played havoc with the machinery in a quiet, insidious way. They had a right to demand a pure article when they were buying kaolin, which they should get, and not sand or mica.

Refining the Clay

Present methods of refining clay were improving, and the industry was beginning to appreciate the value of technical advice from the physicist and chemist, but on the whole present methods were too crude. On the other hand, China Clay was a very cheap commodity when one considered the work involved in winning it from the earth. It would certainly pay the papermaker to insist on receiving purer clays, but he should also be prepared to pay higher prices for the finest kaolin in a perfectly pure state. Lower grades of clay should be valued not by their colour alone, as at present, but also by their physical properties and according to their degree of purity.

The lecture was followed by a discussion, in which the chairman, Messrs. Abel and Black, and others took part.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, December, 1923

Arrived	Name.	Sailed.	Destination.
Dec. 1,	*N. E. Schmidt*	Dec. 15,	Odense
Dec. 1,	*Richard*	Dec. 2,	Plymouth
Dec. 1,	*James Postlethwait*	Dec. 31,	Ardrossan
Dec. 2, S.S.	*Zapor*	Dec. 23,	Barcelona
Dec. 2, S.S.	*Teesbridge*	Dec. 12,	Portland Me
Dec. 2, S.S.	*Jolly Kate*	Dec. 8,	Brussels
Dec. 2, S.S.	*Wearbridge*	Dec. 13,	Portland Me
Dec. 2,	*Mary Ann*	Dec. 20,	Weston Point
Dec. 3, S.S.	*Industria*	Dec. 8,	Antwerp
Dec. 4, S.S.	*Brazil Maru*	Dec. 23,	Baltimore
Dec. 4, S.S.	*Devon Coast*	Dec. 7,	Liverpool
Dec. 4, S.S.	*Farfield*	Dec. 13,	Preston
Dec. 5, S.S.	*Blush Rose*	Dec. 10,	Garston
Dec. 5, S.S.	*Meuse*	Dec. 11,	Passages
Dec. 5, S.S.	*Clyde Valley*	Dec. 9,	Newlyn
Dec. 6, S.S.	*Salcombe Regis*	Dec. 13,	Preston
Dec. 6, S.S.	*Brier Rose*	Dec. 10,	Garston
Dec. 6, S.S.	*Bruxelles Maritime*	Dec. 12,	Brussels
Dec. 6,	*Two Sisters*	Dec. 11,	Penryn
Dec. 6,	*Jane Slade*	Dec. 10,	London
Dec. 8, S.S.	*Branstone*	Dec. 14	Antwerp
Dec. 8, S.S.	*Ratapiko*	Dec. 13,	Gravesend
Dec. 8, S.S.	*Rudolf*	Dec. 15,	Skien
Dec. 9, S.S.	*Nigretia*	Dec. 15,	Antwerp
Dec. 10, S.S.	*Ciscar*	Dec. 15,	Genoa
Dec. 10, S.S.	*Eskbridge*	Dec. 20,	Philadelphia
Dec. 10, S.S.	*Hayle*	Dec. 13,	Preston
Dec. 10, S.S.	*Tofuku Maru*	Jan. 3,	Boston, U.S.A.
Dec. 10	*Jane Banks*		*
Dec. 13, S.S.	*Golfer*	Dec. 19,	Granton
Dec. 13, S.S.	*Mersey*	Dec. 18,	Ridham
Dec. 13, S.S.	*Industria*	Dec. 18,	Rochefort
Dec. 14, S.S.	*Pickmere*	Dec. 19,	Liverpool
Dec. 14, S.S.	*System*	Dec. 20,	Rochester
Dec. 14,	*Camille*	Dec. 20,	Granville
Dec. 14,	*Fanny Crossfield*	Dec. 21,	Par
Dec. 14, M.V.	*Mogens Koch*	Dec. 22,	Hamburg
Dec. 15, S.S.	*Sutton*	Dec. 19,	Weston Point
Dec. 16, S.S.	*Artificer*	Dec. 20,	Fleetwood
Dec. 16, S.S.	*Gouwestroom*	Dec. 21,	Amsterdam
Dec. 17, S.S.	*St. Francois D'Assise*	Dec. 22,	Rouen
Dec. 17,	*Amy*		*
Dec. 17,	*Snowflake*	Dec. 20,	Par
Dec. 18,	*Ornen*	Jan. 10,	Odense
Dec. 19, S.S.	*Isabella*	Dec. 24,	Dunkirk
Dec. 19, S.S.	*Achille Bayart*	Dec. 28,	Rouen
Dec. 19, M.V.	*Mayls*	Dec. 22,	Charlestown
Dec. 20, S.S.	*Ravenspoint*	Dec. 25,	Genoa
Dec. 20,	*Alice Williams*	Dec. 21,	Charlestown
Dec. 20, S.S.	*Brier Rose*	Dec. 27,	Runcorn
Dec. 20, S.S.	*Ualan*	Dec. 28,	Ridham
Dec. 21, S.S.	*Hegre*	Jan. 1,	Leghorn
Dec. 21, S.S.	*Mistley*	Dec. 29,	Antwerp
Dec. 21, S.S.	*Alekto*	Dec. 29,	Methil
Dec. 22, S.S.	*Primrose*	Dec. 29,	Preston
Dec. 22,	*Helena Anna*	Dec. 29,	Bristol
Dec. 24,	*Alice Williams*	Dec. 31,	London
Dec. 25, S.S.	*Freighter*	Dec. 29,	Newcastle
Dec. 25, S.S.	*Stonehenge*	Jan. 1,	Weston Point
Dec. 27, M.V.	*Margot*	Dec. 31,	Brussels
Dec. 27, S.S.	*Seatonia*	Jan. 3,	Portland Me
Dec. 27, S.S.	*Urpeth*	Jan. 4,	Brussels
Dec. 28, S.S.	*Othem*	Jan. 4,	Haugo
Dec. 28, S.S.	*Kylebute*	Jan. 2,	Leith
Dec. 29, S.S.	*Pearl*	Jan. 4,	Rouen
Dec. 29, S.S.	*Royal Firth*	Jan. 4,	London
Dec. 29, S.S.	*Seaforth*	Jan. 4,	Preston
Dec. 30, S.S.	*Liana*	Jan. 5,	Drammen
Dec. 31, S.S.	*Tynesider*	Dec. 31,	Charlestown
Dec. 31,	*Rose*	Jan. 4,	Looe
Dec. 31, S.S.	*Falmouth Castle*	Jan. 4,	Runcorn

Par Harbour Shipping—December, 1923

Arrivals

Date.	Vessel.	From.
Dec. 2,	*Altair*	Falmouth
Dec. 5, M.V.	*St. Austell*	Salford
Dec. 5, S.V.	*Louise*	Falmouth
Dec. 6, S.V.	*Katherine*	Falmouth
Dec. 14, S.V.	*St. Michael*	St. Brunx
Dec. 15, S.V.	*Two Sisters*	Penryn
Dec. 19, S.V.	*Snowflake*	Runcorn
Dec. 20, S.V.	*Triumph*	Plymouth
Dec. 21, S.V.	*Fanny Crosfield*	Cardiff
Dec. 21, S.S.	*Katherine*	Plymouth
Dec. 21, S.S.	*River Humber*	Avonmouth
Dec. 22, S.S.	*Robrix*	Hull
Dec. 22, S.V.	*Amy*	Falmouth
Dec. 23, S.V.	*My Lady*	Port Talbot
Dec. 24, S.V.	*Leader*	Plymouth
Dec. 28, S.S.	*Fowey*	Penzance
Dec. 29, S.S.	*Katherine*	Plymouth
Dec. 30, S.S.	*Fanny*	*

Sailings

Date.	Vessel.	Destination.
Dec. 5, S.S.	*Wave Queen*	Erith
Dec. 6, S.S.	*Jane Slade*	London
Dec. 9, S.S.	*Katherine*	Plymouth
Dec. 11, M.V.	*Katie*	London
Dec. 11, M.V.	*St. Austell*	London
Dec. 12, S.V.	*Louise*	Penarth
Dec. 15, S.V.	*Altair*	Dundee
Dec. 22, S.V.	*St. Michael*	Boulogne.
Dec. 22, S.V.	*Katherine*	Plymouth
Dec. 22, S.S.	*Robrix*	Charlestown

Charlestown Shipping—December, 1923

Arrivals

Date.	Vessel.	From.
Dec. 1	*Lydia Cardell*	Beynon
Dec. 5	*Beeston*	Newhaven
Dec. 9	*Venturen*	Mevagissey
Dec. 11	*Armanda*	Truro
Dec. 12	*Conis Crag*	Barrow
Dec. 15	*Madelene*	Perros Guires
Dec. 19	*Eleth*	Falmouth
Dec. 20	*Alice Williams*	Torquay
Dec. 21	*Urda*	Frangsand
Dec. 22	*Robrix*	Par
Dec. 23	*Myals*	London
Dec. 24	*Concordia*	Fenit
Dec. 29	*Water Witch*	Falmouth
Dec. 20	*Sanrikt*	Christiansand

Sailings

Date.	Vessel.	Destination.
Dec. 6	*Lydia Cardell*	Rouen
Dec. 8	*Beeston*	Fleetwood
Dec. 12	*Conis Crag*	Barry
Dec. 13	*Venturen*	London
Dec. 14	*Amanda*	Preston
Dec. 24	*Sangrikt*	Rochester
Dec. 22	*Eleth*	Preston
Dec. 20	*Madelene*	Nantes
Dec. 24	*Alice Williams*	London
Dec. 24	*Robrix*	London

Par Harbour Tide Table, January, 1924

(Greenwich Mean Time throughout.)

Day of Week.	Day of Month.	Morning	Afternoon.	Height.
Tuesday	1	11.49	—	10. 8
Wednesday	2	0.26	1. 1	10. 0
Thursday	3	1.38	2.13	11. 6
Friday	4	2.48	3.21	12. 4
Saturday	5	3.51	4.20	13. 0
SUNDAY	6	4.48	5.16	13. 5
Monday	7	5.43	6. 7	13.10
Tuesday	8	6.31	6.53	14. 1

Wednesday	9	....	7.14	....	7.34	....	13.11
Thursday	10	....	7.54	....	8.15	....	13. 3
Friday	11	....	8.33	....	8.52	....	12. 5
Saturday	12	....	9.11	....	9.32	....	11. 7
SUNDAY	13	....	9.53	....	10.14	....	10. 9
Monday	14	....	10.38	....	11. 4	....	10. 1
Tuesday	15	....	11.34	....	—	....	9. 8
Wednesday	16	....	0. 8	....	0.43	....	9. 7
Thursday	17	....	1.20	....	1.55	....	9.11
Friday	18	....	2.28	....	3. 0	....	10. 5
Saturday	19	....	3.29	....	3.55	....	11. 0
SUNDAY	20	....	4.17	....	4.39	....	11. 6
Monday	21	....	5. 1	....	5.22	....	11. 9
Tuesday	22	....	5.41	....	6. 1	....	12. 9
Wednesday	23	....	6.20	....	6.39	....	13. 4
Thursday	24	....	6.56	....	7.13	....	13. 4
Friday	25	....	7.30	....	7.49	....	13. 2
Saturday	26	....	8. 8	....	8.23	....*	12. 9
SUNDAY	27	....	8.47	....	9. 7	....	12. 3
Monday	28	....	9.28	....	9.51	....	11. 9
Tuesday	29	....	10.15	....	10.44	....	11. 2
Wednesday	30	....	11.13	....	11. 9	....	10. 8
Thursday	31	....	—	....	0.29	....	10. 6

H. L. VICARY, Harbour Master.

December China Clay Deliveries

DESPITE the intervention of the Christmas holidays, which would have justified a falling off of the tonnage recorded in December, the figures of total China Clay and china stone deliveries last month revealed an increase of nearly 2,000 tons, the figures being 69,364 tons against 67,908 for the previous month.

The total tonnage, including China Clay, china stone and ball clay shipped from Fowey, reached 61,584 tons, compared with 55,155 tons in November. As the figures given under this heading are intended to show the totals of China Clay and china stone, the ball clay figures are excluded from the total given in the above paragraph.

December's figures bring up the tonnage of China Clay and china stone shipped for the year to the handsome total of 820,393 tons, compared with 737,486 tons for 1922, and nearly reaching the post-war record year of 1920.

The total shipped through Fowey for the year created a post-war record, the monthly record having only twice been exceeded for the year, namely, in January and May.

Taking the total tonnage from all ports and by rail, December proved to be the third best month of the year, having been exceeded by only January, with 74,000 tons, and July, with 71,000 tons.

The details are as follows :—

Port.	Tonnage.
Fowey (China Clay)	55,190
Fowey (China Stone)	3,483
Charlestown	2,949
Par	1,954
Plymouth	577
Total by sea	64,153
Deliveries by rail throughout	5,211
Grand total	69,364

The growing increase of traffic through Fowey is due to the operations of the new No. 8 electrical jetty. Experience in working disclosed one or two minor defects which have now been remedied, and certain minor improvements have been introduced which have enabled this up-to-date and quick-loading apparatus to deal with cargoes much more expeditiously.

It is gratifying to note that January has opened well, and shipping from Fowey has been brisk and promises to continue so throughout the month.

Some of the principal shipments during January were :— Japanese s.s. *Ohio Maru*, 7,500 tons to Boston, Mass.; British s.s. *Dorrien Rose*, 1,300 tons to Westonpoint; British s.s. *Florentino*, 1,100 tons to Genoa; British s.s. *Teesbridge*, 5,500 tons to Portland, Maine; Norwegian s.s. *Rudolf*, 1,250 tons to Skien; British s.s. *Wearbridge*, 6,000 tons to Portland, Maine; Swedish s.s. *Manfred*, 770 tons to Viborg; Belgian s.s. *Meuse*, 700 tons to Passages; British s.s. *Ciscar*, 665 tons to Genoa; British s.s. *Nigretia*, 650 tons to Antwerp; British s.s. *Eskbridge*, 5,500 tons to Philadelphia; Japanese s.s *Brazil Maru*, 7,000 tons to Baltimore; German m.v. *Annen*, 600 tons to Karlskrona; Danish m.v. *Mogens Koch*, 570 tons to Hamburg; British s.s. *Ravenspoint*, 770 tons to Genoa; Norwegian s.s. *Alekto*, 700 tons to Methil; French s.s. *Achille Bayart*, 775 tons to Rouen; Dutch s.s. *Gouwestroom*, 1,770 tons to Amsterdam; Italian s.s. *Zapor*, 300 tons to Barcelona; Norwegian s.s. *Hegre*, 1,650 tons to Leghorn; Swedish m.v. *Margot*, 570 tons to Brussels.

China Clay Exports

RETURN showing the exports of Clay, China, the Produce of Manufacture of the United Kingdom from the United Kingdom to each Country of Destination, registered during the month ended December 31, 1923 :—

Country of Destination.	Quantity Tons.	Value. £	
Finland	759	1,218	
Sweden	2,723	6,413	
Norway	761	1,753	
Denmark	161	506	
Germany	326	948	
Netherlands	2,080	5,198	
Belgium	4,056	8,507	
France	2,922	5,722	
Portugal	10	63	
Spain	729	1,905	
United States of America	13,958	34,063	
Argentine Republic	4	105	correct
Irish Free State	5	19	price.
Bombay, *via* other Ports	865	3,522	
Bengal	74	296	
Western Australia	—	1	
Victoria	55	267	
New South Wales	11	60	
Total	29,499	70,566	

Commercial Intelligence

County Court Judgment

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

CURRIDGE BRICK AND TILE CO., LTD., 30, Golden Square, and of Curridge, near Newbury, brick and tile manufacturers. £13 10s. 8d. November 14.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

RIGBY AND STEVENSON, LTD., Hanley, earthenware manufacturers. Registered November 30, mortgage, to bank; charged on Pelham Street Works, Hanley, with machinery, etc. *Nil. March 24, 1922.

SELBY BRICK AND TILE CO., LTD. Registered November 27, mortgage, to bank; charged on properties at Selby.

WEST HENSBARROW CHINA CLAY CO., LTD. Registered November 29, £500 debentures, part of £10,000; general charge. *£3,000. July 9, 1923.

LUCAS LONGFIELD AND CO., LTD., Birmingham, paper manufacturers. Registered December 5, £200 debentures, to H. Kershaw, 48, Comberton Hill, Kidderminster, coal merchant; general charge.

MALPAS BRICK AND TILE CO., LTD. Registered December 5, £600 debentures (secured by Trust Deed, dated November 29, 1923); charged on brickworks, etc., in parish of Maplas; also general charge. *£1,141. October 31, 1922.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

The Railway Strike

THE unfortunate dispute between the railway companies and a section of their employees had its effect on the shipments of China Clay last month.

At one time the position looked really serious. Coal was difficult to obtain, and truck loads of clay ready for shipment lay idle; in a particular case two steamers which arrived at Teignmouth to load China Clay had to leave empty. The dispute has been settled, but there are many who think that it might well have been arranged without such drastic measures being taken, bringing great misery to thousands and much dislocation to trade.

It came at a time when our new Government had just come into power, and we hope and believe that they fully realise the seriousness of such methods and will use every effort in future industrial struggles to avoid this wasteful warfare.

Mr. Ramsay MacDonald wants peace with all the world—and rightly so, but we must first have peace at home.

Perhaps whilst the League of Nations settles the disputes of nations, a National League may arise to settle our home disputes.

The China Clay industry has passed through difficult times and is still handicapped in its trade through causes over which it has no control. It has, therefore, no desire to see these hard times added to by unnecessary strikes.

Our figures have shown that last year the industry was beginning to get back into its pre-war stride, after many years of depression.

Producers were looking to 1924 to increase their output, and it may be that this year will see Russia in the market once again. The peace of the world and peace at home are essential for the trade of the country and for the China Clay industry with its high export trade in particular.

China Clay is, after coal, the largest export trade of raw materials from the British Isles, so that all efforts made by our Labour Government to settle industrial disputes without resource to strikes will receive the unqualified support of the China Clay industry.

Colloidal China Clay

WE publish in this month's issue of THE CHINA CLAY TRADE REVIEW an interesting article by Mr. Searle on "Colloidal Clay." This gentleman has been thanked for previous articles, dealing with the same subject, but some readers have said that they do not go far enough and exlpain how Colloidal Clay can be made. Those producers who are already marketing Colloidal Clay (we use the term "Colloidal Clay," because a very finely divided clay has become known as a Colloidal Clay, though the term is very misleading, and some definition as to what is going to be sold as Colloidal Clay will have to be arrived at), knowing quite well that every kind of clay has to be examined separately before it can be stated that Colloidal Clay can be produced from it. Some clays are very much better than others for the purpose. There are also many different methods of arriving at the so-called colloidal state of clay, and readers will appreciate the impossibility of giving a definite information to suit any particular clay in articles of this sort.

Each brand of clay must be examined by experts to determine its suitability for the manufacture of Colloidal Clay.

We are convinced that there is a definite market for this clay, call it what you like, "Colloidal" or a very finely divided clay, and some natural clays we have seen approach the colloidal state nearer than others we have seen treated and sold as "Colloidal." The price at which this clay is sold will always be higher than the China Clay is at present supplied. Its manufacture involves considerable extra plant and labour, but the consumer who requires this clay will undoubtedly be willing to find the additional price demanded because of its superiority for certain uses. For medicinal purposes and in the rubber industry it has decided advantages, but we think that those producers who are now manufacturing Colloidal Clay, are not advertising its advantages sufficiently to secure the trade which it might enjoy, when it becomes better known to users of China Clay.

An additional source of income to the trade might well be derived by the development of "Colloidal Clay."

A great deal of interest has been aroused in the trade by our articles, and we hope the additional article of Mr. Searle will do much to stimulate further interest.

Sir Felix Pole

WE would take this opportunity of congratulating Sir Felix Pole, General Manager of the Great Western Railway Co., on the well-deserved honour conferred upon him by the late Government. Sir Felix is well known to the members of the China Clay Association, and was only recently at Fowey, for the opening of the No. 8 Jetty, erected by the Great Western Railway Co. Everyone in the industry who has come in contact with the Great Western Railway's General Manager, recognises his sincere desire to help the expansion of the China Clay trade, and have always found in him a courteous and genial friend, ever ready to listen to suggestions and where practical to carry them out.

We wish Sir Felix Pole long life, health and happiness to enjoy his honour, and trust that the pleasant relations now existing between the Railway Company and the China Clay trade may be continued. There have been times in the past when the China Clay Producers have sent many telegrams and deputations to Paddington urging the swift completion of No. 8 Jetty, but throughout these negotiations it was evident that the Railway Co., of which Sir Felix is the moving spirit, desired to push forward with better loading facilities; and when last year No. 8 Jetty was completed and working, and the General Manager and many of his staff came down for the opening ceremony, it was felt that the Railway Co. were fortunate in having so young and able a man at its head.

Among the Cornish China Clay Mines

An Interesting Review of the United China Clay Group

THE China Clay industry of Cornwall has invariably presented an attractive field for enterprise and development, particularly so within the past decade—after so many years of commercial disorganisation and industrial depression created by the War, it is like the " waft of a refreshing breeze " to realise that the China Clay industry is gradually climbing back to prosperity, by wise administration and of course with concurrent trade restoration. It is doubtful whether there has even been a period within living memory when care and prudence in handling this great white industry was more essential. China Clay enters so many refined uses, that it has become imperative to the producer to see that the clay he has to sell is denuded of all impurities. The United China Clay Co., Ltd., of 80, Bishopsgate, E.C., has not only been successful in this respect, but has also shown conspicuous enterprise in the speeding up of the whole of their mines. Taking advantage of a commission from the Editor of THE CHINA CLAY TRADE REVIEW, the writer, although conversant with the trade, experienced quite a revelation during a trip around the United China Clay Co.'s Mines. Unfortunately, it was one of those bleak mornings in December, when the district was clad in white. The car,

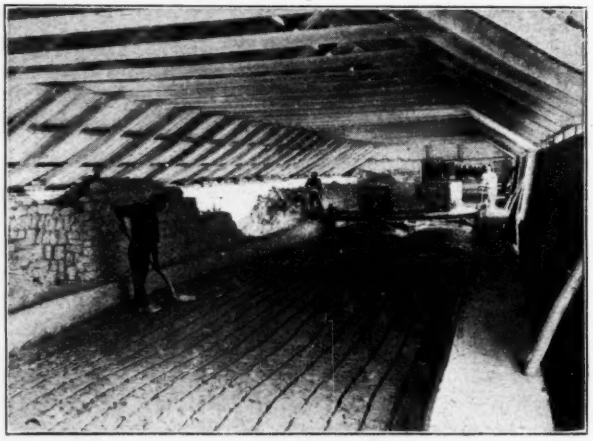
LITTLEJOHNS CLAY PIT.

however, sped over the hail and snow covered roads to the first mine of the Group at Western, which is situated in the Parish of St. Dennis—according to tradition, the famous Josiah Wedgwood was interested in a China Clay bed adjoining this very mine. This mine produces an almost unrivalled potting clay, known amongst potters as the W.P. Brand. It fires a good colour, and is remarkable for its strength, combining well with other materials—potters have testified that Western clay neutralises the tendency to cracking in the process of production—and dunting in the finished article. This work embodies excellent facilities for production. Washing is done by hydraulic hose, the pressure being obtained by gravitation. The sand, and all other extraneous matter, is removed from the pit to the high mounds on the surface, which form quite an interesting feature of the landscape in the China Clay areas. This waste sand is hauled up over a very steep incline in skip-wagons, and automatically deposited on the dumps. The refining micas and settling pits are well constructed and the apparatus successfully extracts all foreign and undesirable substances. The machinery includes a large Cornish rotary pumping engine of 200 h.p., which is used exclusively for raising the liquid clay from the pit to the surface, a height of over 30 fathoms—or nearly 200 feet. Another engine—a horizontal double-cylinder—is used principally for winding. When the clay has passed through its refining stages it is conveyed, by a short pipe-line, to the tanks at Parkandillack, where the drying kilns are situated alongside the St. Dennis Branch of the Great Western Railway. Only a short walk across the gorse-covered waste land divided the Trelaver works from the Western Mine, which was accomplished under improved climatic conditions. The Trelaver Works were very familiar to the writer, and here one could hardly fail to observe the very considerable economies in operation. Most conspicuous were the saw-mills, and separate establishments for carpentry, smithery, and engineering, whereby the firm execute the major part of their new require-

LITTLEJOHNS—MICA DRAGS.

ments for the whole of their mines, such as tram-wagons, skip-wagons, wheelbarrows, etc., and effect their own repairs.

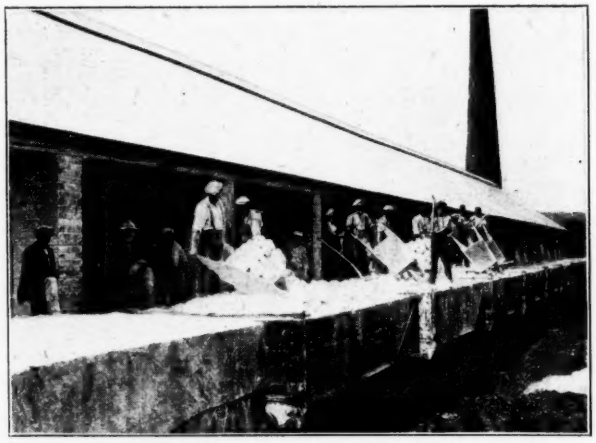
Trelaver is a notable pit in many respects. It is 35 fathoms deep, and discloses an enormous bed, equal to, if not surpassing, some of the best clays in the district. The T.I. clay is used by papermakers for coating high class papers, and is also suitable for the reproduction on paper of photographic blocks. The brand known as the T.N. clay appears to be a great favourite as a filler, and is extensively used as a newsprint as well as in the manufacture of paint. Trelaver Works are well situated and are capable of a very much larger output. Pumping operations are still entrusted to the steam engine, but the compound tandem engine of 150 h.p. is regarded almost with affection by the men who drive it, on account of its reliability. An engine of smaller dimension is used for winding



CARBIS DRY—INTERIOR VIEW.

and other minor purposes, and an additional engine supplies power to the saw-mills and fitting shops. The hydraulic hose is used for washing, and the waste sand is trapped into boxes or sand drags, and these are so constructed as to be accessible to the tram-wagons at the bottom of the pit, which, when filled, are drawn up to what are locally known as sky-tips.

Trelaver Mine is equipped with an accelerated winding apparatus, and it is interesting to observe how each wagon, whether ascending the incline or descending, is controlled by the engine driver by means of an ingenious indicator. The micas at Trelaver are rather unique, and have been constructed by Capt. Lobb, the mine superintendent, on an improved pattern of his own design. Capt. F. Lobb has been associated with the Trelaver Works for many years, whilst his connection with the company's works extends over 35 years, and he is naturally proud of the development of this work or mine in particular. The drying operations for the Western and the Trelaver Mines are carried out at Parkandillack, and here the firm has a drying capacity of nearly 20,000 tons per annum. There are three kilns adjacent to the firm's own sidings, consequently orders for large or small consignments receive prompt despatch, and 600 tons per day can be loaded at this centre. The storage accommodation at Parkandillack, both for wet and dry clay, is spacious, and every precaution is taken to maintain the very high standard of these clays. At Carbis



CARBIS DRY—LOADING CLAY.

the firm have a kiln with a drying pan 330 feet long, practically one of the largest and best constructed in the district. There is a very commodious Linhay for the storage of dry clay alongside the whole length of the dry, which is contiguous to the railway siding on the Bugle branch of the Great Western Railway. Carbis has become an important centre of late years, and with the development of the United China Clay Co.'s Mines at Littlejohns and West Goonbarrow, the drying capacity of the firm may have to be extended. The visit to Littlejohns, which is in the neighbourhood of Hensbarrow and Cocksbarrow, the highest altitudes in the St. Austell district, revealed one of the most entrancing panoramic views of the county that one could possibly wish to see. Littlejohns is unquestionably a good mine, and the clay produced is used by papermakers as a filler and for medium coating. For linoleum manufacture this L. J. clay is also particularly suitable. The L.J.N. clay has a good demand for coating paper of superior quality. It is also pronounced to be a superior bleaching clay and suited to the users of chemical manufactures. The pumping is effected by a horizontal compound tandem engine of about 120 h.p., whilst a horizontal winding engine supplies the motive power for the winding machinery. This work is well laid out, and with its self-landing settling pits and extensive new micas, only completed last summer, is considered ideal by those conversant with the industry. The clay is conveyed in its liquid condition to the kiln at Carbis, a distance of nearly three miles. The output of Littlejohns is about 6,000 tons per annum, but is capable of considerable extension. The last of the Group—the West Goonbarrow Works—is situated in the very best clay-producing area in the county. Here there are installed a Cornish rotary pumping engine and a vertical winding engine. An excellent potting clay, known as W.G.B.A., is produced here, greatly in favour with manufacturers of porcelain and wares requiring clay of medium strength but excellent colour. A medium bleaching clay is also produced at this mine. The clay of this mine is also conveyed to the kiln at Carbis for drying, and the original dry at West Goonbarrow is retained for drying mica clay from the West Goonbarrow and also the Littlejohns mines.

It is hoped that this résumé will illustrate the progressive policy adopted by the United China Clay Co., Ltd. There are other works under the same management, but with a separate directorate.

The directors, and the managing director, Mr. W. E. S. Taylor, deserve much credit for the position held by this company in the China Clay trade.

Careful and constant supervision over production is exercised, and excellent relationships exist in consequence between this firm and both their work-people and customers.

Another Oil Fuel Plant

It is interesting to learn that another China Clay producing firm have adopted the oil fuel plant for drying clay. Mr. R. J. Varcoe, managing director of the St. Dennis and Parkindillack China Clay Co., has just informed our St. Austell representative that the Shell-Mex oil plant installed in their drying kiln at Parkindillack is affording great satisfaction and the directors are even contemplating the erection of a new dry before the expiration of the present year. The Parkindillack dry has not been in use many years, and what has impressed Mr. Varcoe and his Board of Directors has been its easy conversion from the old system to the new—and without any great structural alterations. The old fire-boxes were, of course, taken out, but the flues or heating chambers were left to remain. A small power steam engine has been installed which pumps the oil from the rail-tank to the storage tank, and thence to the feeding tank over the burners. This engine also supplies the steam to heat the oil before it is transmitted to the burners. There are three burners, known as Rotamisor burners, and these are fed by gravitation, and the pressure of air is produced by a fan. The distribution of heat is wonderfully regulated, and burners can be seen from an observation aperture when required by the operator. This innovation, remarked Mr. Varcoe, has many advantages over coal. It has certainly a greater drying capacity and eliminates the soot from the high chimneys, which too frequently blows down into the tanks of wet clay. It also avoids coal dust when coals are being unloaded. Mr. Varcoe thinks that the transportation of oil is at the moment rather expensive, but no doubt if oil becomes more generally used by clay producers some cheaper method is bound to evolve. Already the Shell Mex Co. have been making frequent endeavours to select a sea-board site in Cornwall so that it might provide a cheaper channel of transport to large uses. The new method is not by any means a labour-saving proposition. Under the old system the men engaged in the kilns superintended their own fires and took their turn to stoke up the fires for the night. In addition to this they filled the pan with wet clay as required and shovelled the dry clay into the adjoining tin trays. With the oil fuel one man has to be in attendance all the time, which means three shifts of 8 hours. A large tank has been completed at Parkindillack contiguous to the prospective new dry, and has been so constructed that it can be used in connection with the present dry. When the new dry is erected, the furnace ends will be so close that the same motive power will be sufficient and one operator could well look after the both, and the new system would then work out very economically.

In the course of a brief conversation, Mr. Varcoe expressed his surprise that the British Government has debarred the use of China Clay in the manufacture of certain Government paper, because it is certified in the official forms that such papers are to be manufactured free from fillers. As China Clay enters into the filling as well as coating—in the manufacture of paper, it is thus debarred. It would be interesting to learn what real effect the elimination of China Clay can have on paper when it is so extensively used in its general manufacture. There are other peculiar features regarding the industry which Mr. Varcoe directed attention to. The activity of the Italian market was very remarkable at present and the producers are even wondering whether she is consuming all the clay that is being sent into that country or not, or whether it is being distributed into other countries.

China Clay Trade and Cheap Power

THE internal combustion engine comprises one of the cheapest forms of power when this has to be developed from fuel—whether coal or oil. Cheap power to-day is of utmost importance to most manufacturing concerns, and in dealing with the China Clay industry it is most essential to keep down the costs of production to the minimum, if the volume of trade is to be maintained and increased.

Examples have been given in this journal from time to time illustrating gas power installations at China Clay works, and it is now proposed to give some technical details relating to the design and construction of Gas Engines and Gas Plants, and which may be looked upon as typical of the best modern practice. In our next issue we propose to give similar descriptive details relating to modern Oil Engines.

The choice of a prime mover, whether gas or oil, must necessarily depend upon circumstances, taking into account the relative cost of fuels, size of installation, hours of working, load factor and many other details, so that it is not possible to say off-hand which is the best type of prime mover to instal until these conditions are known and carefully studied. In this respect the power plant manufacturers offer the services of their technical staff quite freely for the purpose of helping those interested to arrive at a correct soluion of their problem.

The following details of construction together with the illustrations refer especially to Crossley gas engines and suction gas plants.

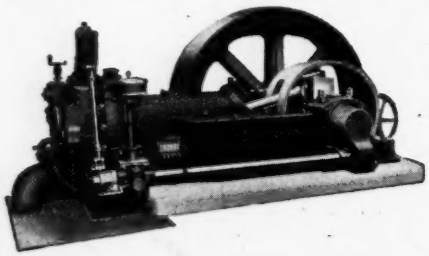


FIG. 1.—SINGLE CYLINDER HORIZONTAL TYPE, 130 B.H.P.

Fig. 1 illustrates a single cylinder horizontal type gas engine, which is built in sizes from 16 to 130 B.H.P.

Fig. 2 shows a double cylinder engine for dealing with powers up to 260 B.H.P. In the same way engines of larger power would have three or four cylinders, and this avoids the use of pistons and cylinders of large dimensions.

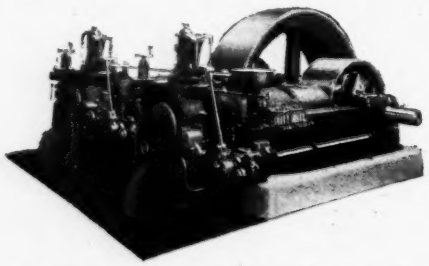


FIG. 2.—DOUBLE CYLINDER GAS ENGINE, 188 B.H.P.

According to the size of the power unit the drive may be by belt or ropes. In many cases to-day electrical driving is being adopted, and this is especially useful where the machinery to be driven is remote from the engine, so that long transmission shafting is avoided.

Fig. 3 illustrates the gas engine coupled to a suction gas plant—the fuel used being anthracite or coke. According to the cost of these fuels and the size of the plant to be installed, it may be found advantageous to use bituminous fuel, in which case the construction of the gas plant whilst operating on the suction principle is somewhat different. An example of a suction bituminous gas plant is given in Fig. 4. The main difference consists of the addition of a centrifugal tar extractor for removing tar and other impurities contained in bituminous coal. Anthracite fuel is comparatively free from tar so that an extractor is not required when using such fuel.

The modern gas engine comprises a very much better proposition compared with its predecessor, which operated upon what is known as the " hit and miss " system of regulation. Instead of this, a system known as " variable admission governing " has replaced it, whereby the amount of air and gas mixture entering the cylinder during each power stroke is automatically regulated from the governor. Thus a series of graduated explosions occur, one every working stroke. In this way very much better and steadier driving is obtained from the engine. The moving parts are subjected to reduced working stresses becaue the impulses are regular and not intermittent and this results in reduced wear and tear and a quieter running engine.

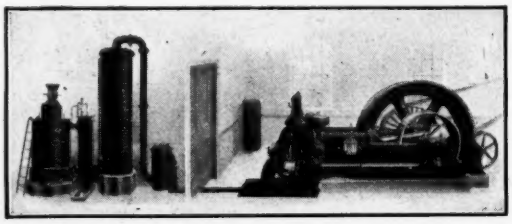


FIG. 3.—100 B.H.P. GAS ENGINE AND GAS PLANT.

The variable admission valve gear on the Crossley engine is so arranged that the governor lever controls a movable fulcrum, which in turn acts upon a radius lever, causing the admission valve to open by an amount sufficient to give an impulse exactly proportioned to meet the load requirements at the engine. A section showing the design of the admission valve is given in Fig. 4. The upper valve controls the gas admission and the lower valve controls the mixture entering into the engine cylinder. Both valves are arranged on one common spindle, which is operated in the usual way by lever and rod from the inlet cam fixed on the sideshaft of the engine.

The lubricating arrngements are very complete and have received special consideration. Continuous ring oiling is arranged upon the main and sideshaft bearings and pump lubrication is fited to the cylinder, piston, piston pin and exhaust valve. This ensures that the engine after being started up can be left unattended many hours and until it is necessary to shut down.

The ignition arrangements are likewise very complete and accessible. The system of ignition adopted is low tension. The reliability of the gas engine depends very largely on its magneto and the operating gear, and this has been made strong and free from all intricate working parts.

The sparking plug is of the make and brake type and so placed that the sparking points come within the combustion chamber in the best position to ensure perfect firing of the charge every time.

The starting of the engine is effected by means of compressed air drawn from a mild steel storage receiver. This method ensures absolute certainty in starting up the gas engine and without any shock such as is caused with other methods of starting. The engine is barred round to its starting position and the attendant has then merely to open the compressed air valve when the automatic cam opening gear provided ensures the compressed air entering the cylinder at the correct moment. After starting up, the compressed air valve is shut to avoid any further loss of compressed air. The storage receiver is charged up from a small air compressor driven by belt from the main engine or shafting or from a small auxiliary starting engine. The latter equipment is usual in the case of large engines.

Suction Gas Plant

The outstanding features of the Crossley Suction Plant, included in Fig. 3, relate to its open hearth with stepped firegrate also to the external vaporiser used for steam raising purposes. The stepped grate consists of a series of circular flat plates upon which the fuel is supported in sections. The plates forming the grate lie outside the angle of repose of the fuel, and this ensures that none of the fuel will of itself fall from the grate. Below the bottom stepped grate the fuel itself rests on its own bed of ashes. This type of grate presents a large area for the passage of air and steam into the combustion zone for gas making purposes. It also enables the attendant to observe the condition of the fire at any time and remove any clinkers or ashes from the fuel bed without disturbing the process of gas making. This is a very important feature resulting in a more uniform quality of gas being manufactured under all running conditions. It is found that with this type of firegrate inferior grades of anthracite or coke fuel can be used to better advantage than upon the closed hearth plant with flat grate.

The external vaporiser, which is attached to the gas producer where the hot gases leave, consists of an outer cast iron casing upon the top of which is bolted a box or header carrying suspended gilled tubes. These tubes have a maximum heating surface to convey the heat extracted from the gas to the water for vaporising purposes. The flow of water takes place down and up these tubes and they are so arranged that the water is quickly flashed into steam resulting in ample supplies of steam being available. The last tube is connected up to a pipe leading underneath the stepped grate and the steam issuing therefrom mixes with the primary air entering below the fire. In addition to the external vaporiser being more accessible for cleaning purposes, the top of the gas producer is thus freed from complications which exist when the vaporiser is situated on top of the producer. Another advantage is in permitting the placing of the poker holes in the gas producer vertical and adjacent to the sides of the firebrick lining, so that should the operator have to deal with badly clinkering coal he is able to pass his poker down the producer sides and remove the clinker without damaging the brick work. This is not the case when the poker holes are on the angle.

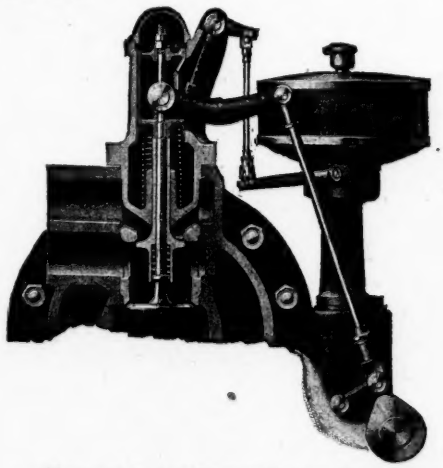


FIG. 4.—VARIABLE ADMISSION VALVE GEAR SECTION.

The following is a list of Crossley gas plant installations in the West of England :—

English China Clays, Ltd.	2–20 B.H.P. engines and gas plants.
" " "	2–32 B.H.P. engines and gas plants.
" " "	1–57 B.H.P. engine and plant.
" " "	3–175 B.H.P. " "
" " "	2–212 B.H.P. " "
" " "	1–119 B.H.P. " "
Lovering and Co., China Clay Producers, St. Austell	1–100 B.H.P. " "
Hensberrow China Clays, Ltd., Hensberrow	1–190 B.H.P. " "

An American's Impressions of the China Clay Works of Cornwall

MR. H. B. MILLS, together with his wife, visited the China Clay works of Cornwall last summer, and upon his return he gave his impressions of his visit in an article in a house organ from which we take the following notes.

Mr. Mills, in kindly sending us the article, at our request, says : " I am told, that on future trips abroad, if I ever take any, I shall not be so everlastingly sure that everything over here is the best in the world, and if the article does give that impression you will have to put it down to the inexperience of youth ! "

Mr. Mills, in the article, says :—

" The United States of America as I discovered it abroad " is a paraphrase which permits me to say that a trip such as I made renews the conviction that it is good to live here ; that we should take greater pride in our Government and institutions, greater satisfaction in our higher and more comfortable standards of living, and in the equality of opportunity which we enjoy.

This country is setting the pace for the world, and the best part of going away is getting back home.

We landed at Plymouth, in Cornwall, Southern England, in order to visit the China Clay fields, and motored 40 miles to Fowey, the loading port, over a good but narrow macadamised road, lined both sides with hedges, which in places were higher than the car. There were no fences of any description. The roads and the moorland boundaries are all separated by hedges, and as the country is divided into comparatively small farms, the general appearance is like a huge checker board.

Fowey is a clean, unique little resort on the English Channel, reminiscent of much of the old-world atmosphere, and with a fine harbour. Pedestrians use the streets as much as the old stone sidewalks, which are about two feet wide. Some of the streets permit motor cars to pass, at owner's risk, but for the most part they have to manœuvre around corners or almost into shops and front yards to pass. Every house seems to have a brass knocker, or brass door bell, and brass name plate, all scintillatingly bright. There is an official Town Crier, who rings a bell through the streets and reads local proclamations. The stately old church, with burial vaults beneath the stone floor and tombs in the chancel, is rich in local tradition. One tomb bears the name of a founder of a family and the dates 1561–1620, and is surrounded by the burial places of other members down to the present time, including two boys killed in the Great War, an impressive example of good old English family lineage and linking of the past with the present.

The clay fields cover about 100 square miles, and can be recognised by the huge heaps of gravel, refuse from the operations, which dot the landscape just as culm piles do in our coal regions. They produce about 500,000 tons annually, principally for the paper and pottery trades in all parts of the world. Incidentally Oxford uses 24,000 tons of this clay yearly at a cost of $400,000, which amount cannot be characterised as at all incidental to our operations.

The pits are simply huge open excavations, up to 250 ft. in depth and a mile or two in circumference at the top. Streams of water play into the sides, and wash the mixture to the bottom, where it is carried along in streams to a settling reservoir, pumped to the top, and distributed through " mica runs," always with a plentiful supply of water, to the final settling pit, at which point it is practically free of mica and grit. The water is then drawn off, and when the clay is sufficiently dried by the air it is shovelled into dump carts and taken to the adjacent drying kilns, where the remaining excess moisture is removed by steam heat. It is then loaded into cars for transportation to the vessel port.

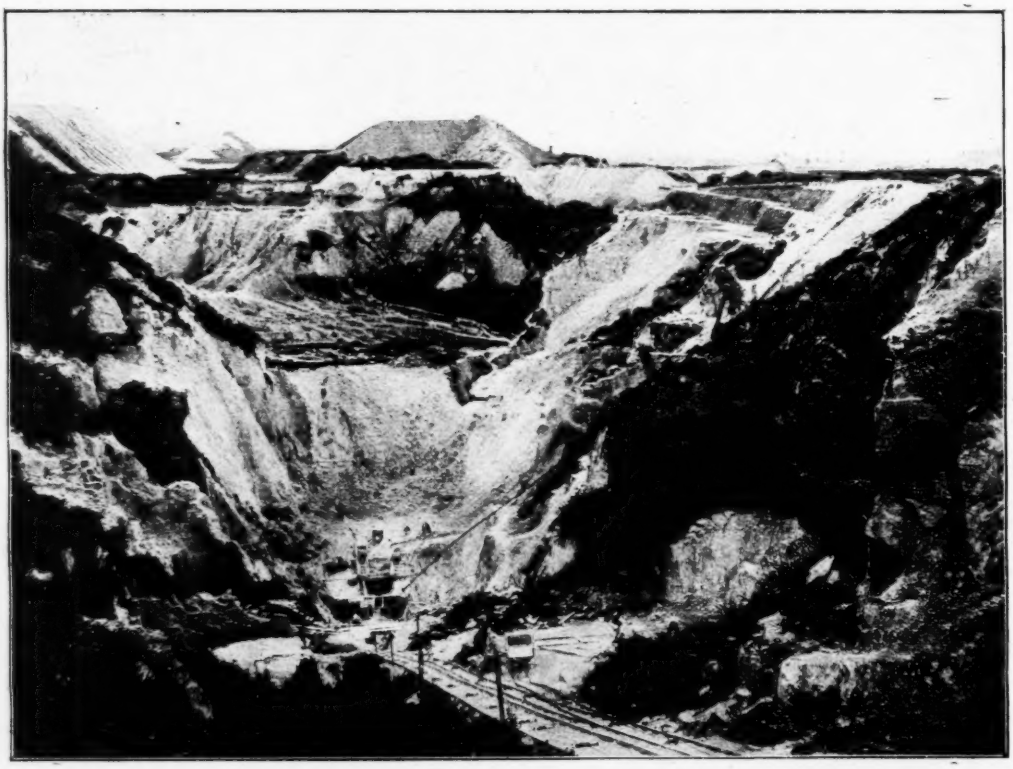
The railroad cars are known as " waggons " and load 10 tons of freight as compared with our standard freight cars of 30 to 40 tons capacity. They look like circus wagons, and inefficient, but must be well adapted to the railroad equipment.

During the week we were at Fowey we motored to many of the Channel and coast resorts, and while it was pleasant to see this feature of English life, nothing was especially distinctive except the practice at the bathing beaches. We noticed many small, individual bathing houses, and were told that English censorship of the human form is very strict ; that each bather is assigned one of these little houses, is pushed to

(Continued on page 14)

ENGLISH CHINA CLAYS, Ltd.

BURGOTHA CLAY WORKS, near Meledor, which was opened just before the war, is celebrated for its potting and bleaching clay.



ENGLISH CHINA CLAYS, Ltd.

LITTLE TREVISCOE CLAY WORKS, St. Stephens, Cornwall. Best potting clay.

(Continued from page 11)

the water's edge by an attendant, and enters at knees or neck, according to the degree of chasteness that propriety demands. This paternal supervision does not extend to all places on the Continent; there is more than one so-called "musical revue" which ought to be suppressed—after you see them!

From Cornwall we took the train to London. We departed and arrived on the minute; the average speed was 56 miles per hour, including stops. First-class accommodations were better than our day coaches, and practically as comfortable as Pullmans. 1st, 2nd and 3rd class accommodations are provided in England and France, and one does not need to be too fastidious to appreciate that this distinction is desirable.

We had a day of exceptional pleasure in motoring to Windsor Castle, the summer place of the King and Queen, although why they should wish to spend any length of time in such a canaverous pile, without any special beauty of location, I cannot fathom.

I have passed over lightly reference to such famous historical places as Windsor Castle and Versailles, for the reason that unless one is especially interested, you are fed up on old masters, old traditions, old relics, old edifices—they are all very much the same everywhere. And while it may interest, and even stimulate, many people to peep into the boudoir once occupied by Napoleon and Josephine, and other similar once sacred and exclusive places, I confess it can become a bore. I also have the feeling that with the evidence of lavish wealth and luxury amid which the old time Courts lived, plus the historic evidence of selfishness, arrogance, wantonness and riding rough-shod over the people at certain periods, that it seems a wonder Constitutional Government was not established in England and France long before it came.

Correspondence

To the Editor of THE CHINA CLAY TRADE REVIEW.

SIR,—As a result of the publication of my serial article on "Colloidal China Clay," a short time ago, I have had several letters asking for more detailed information, so that "any China Clay producer may profitably convert his material into colloidal China Clay." I should be delighted to oblige these correspondents by a further article giving just the information they require if that were possible, but, unfortunately, the product of each works has to be studied separately, and treated accordingly. The proportion of added chemical which suits Rosemellyn does not suit Goonvean (to mention only two well known clays) though a slightly different proportion suits the latter quite well, but not the former.

As you will see from another article I enclose,* I have recently examined most of the different "colloidal clays" on the English market, and whilst I am not at liberty to publish all this information I have about them, it is easy to see in what I have written that most of these clays contain only a very small proportion of truly colloidal clay.

The fact that one specimen is much richer in this material, shows clearly that the other producers have not sufficiently realised the fundamental requirements which must be satisfied if a satisfactory "colloidal clay" is to be produced.

All the information of a general character which is required to produce colloidal clay is in the serial article I published some time ago. The application of the principles therein explained requires the skill and ingenuity which only come of experience, and, therefore, to obtain the best results with any given clay, that clay must be properly investigated by someone with the requisite knowledge of colloidal clay and the skill needed to produce it from any specified clay. Such investigations are often long and tedious; they require special apparatus, if the best obtainable results are to be attained, and so are beyond the powers of all those who do not possess the requisite training in the manipulation of colloids.

The lack of knowledge and skill explains, in my opinion, the poor quality of some of the so-called China Clays now offered for sale. If I could assist some producers to improve the quality of their material I should be pleased to do so, but for the reason stated, earlier in this letter, it is impracticable to do this in the form of an article in the "Review"; I should have to deal separately with the material from each producer.—Yours truly,

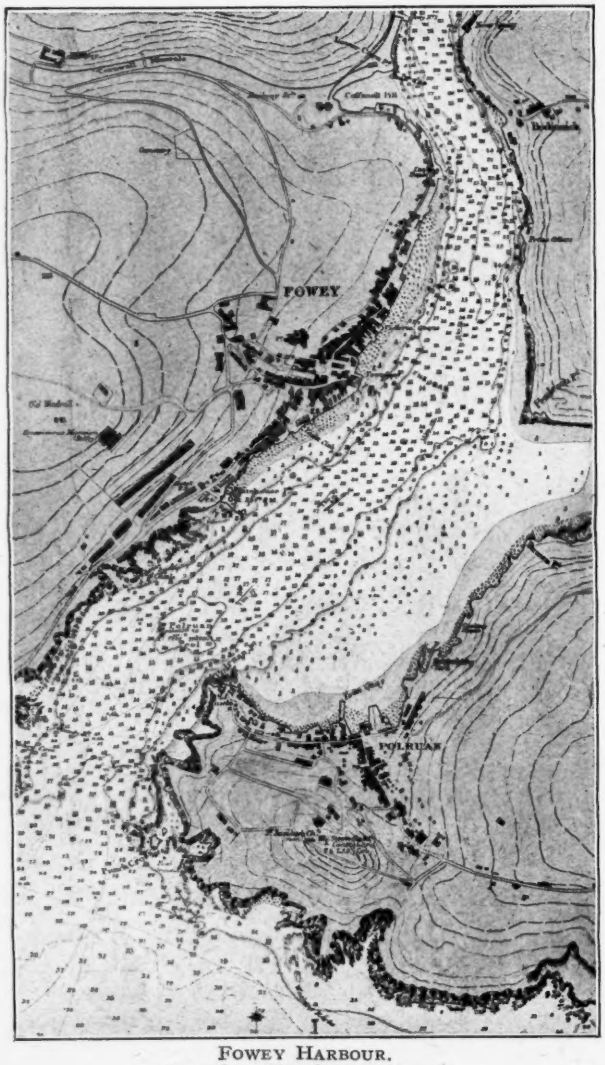
A. B. SEARLE.

* This appears on page 16.

Fowey

By John P. Carter

To realise and appreciate my impressions of Fowey, on taking up my work there, you need to, as I did, have come from a shallow water port with many miles of a narrow winding channel (frequently shifting) through which it was always a source of anxiety to get ships of 12 ft. safely, on high spring tides. Ships continually grounding and remaining a tide or two, perhaps over the neaps, with consequent injury to the weaker ones. Where the incoming tide takes only two hours to flow while the remainder of the 12 hours was occupied by the ebbing tide, towards the finish of which there was little water left except in pools. Pleasure boating was practically



FOWEY HARBOUR.
(Taken from Admiralty Chart No. 31.)

unknown and unsafe. At low water there was an expanse of about 50 square miles of sand and similar area, more sand formed the delta of the river. Imagine coming from this, and finding oneself in the fairyland harbour of Fowey with deep water adjoining the sea, with its loading berths within a mile of the sea, a perfectly beautiful natural sea inlet, more like a lake than an ordinary harbour. Ships could come in without waiting for tides or weather or daylight—simply sail in and sail out as they liked (there were few steamers then), no narrow or shallow channel to worry about, no sandbanks. A harbour filled with clear greeny-blue sea water in which

ships not only of one or two hundred tons but of one or two thousand tons could move and drift about at leisure always afloat and load their cargoes—in fact, you had to take the ships to the banks to put them aground. Keep them in the deep water harbour and they were always free to move. It was incredible, it was fairyland, it was ideal. The relief of it all! There was comparatively no flow or ebb of tide; it seemed to me that the sea raised the height of the water and lowered it again—the tide was nothing. Children, almost babes, could single-handed pull (with oars) a large boat about in the tideway, and boats could be sailed about this fairyland

THE LATE MR. SYMONS WATCHING THE LOADING.

harbour. Instead of miles of dreary sandbanks you had a beautiful picture to admire in any direction you chose to look, bracken covered hills, fruit orchards, masses of wooded plantations and an old world town. In fact, it was all beyond my ability to describe—even our famous writer could not do it justice. It was the most wonderful place I had seen, and I had seen a few. There was no channel to keep to; inside or out. The delight of it to find one's business here. That is a long time ago. September, 1896. When I came down to join the late Mr. J. L. Toyne, as partner, the beginning of a very happy association. He was a man and a good sport; we trusted each other, and there was no need of signatures between us. The late Mr. W. Symons was then Station Master

NO. 4.—WITH AMERICAN "LAKE," A WAR-TIME STEAMER ALONGSIDE.

and Railway Agent in charge of the jetties—a very capable man, unfortunately later troubled with gradually failing sight. Mr. Anthony Hoyte was the contracting stevedore, James Hill, foreman stevedore, John Harris, his assistant, the present contracting foreman stevedore, Captain T. Slade, Harbour Master.

There were no electric capstans then. Horses did the hauling of the clay trucks about. These were then mostly 8 ton iron ones which tipped the clay much more quickly owing to their smooth slippery sides (see photo of the late Mr. Symons watching a truck being withdrawn after tipping). This was a long time ago, as mentioned above. Fowey to me is still as beautiful. Now ships not only of 1,000 to 2,000 tons but 10,000 to 12,000 can come in fully loaded, and sail always afloat. Is there another natural harbour in the kingdom anything approaching it?

Then, it was ships of 200 to 300 tons that mostly were dealt with and, except in the "Bristol" steamers, each merchant chartered his own ship; no two merchants would load in one ship. There was no China Clay Association. The merchants knew each other, but that was about all, or so it seemed. There was no 'phone—it was all messenger, personal, or telegraph or letter. Most of the American China Clay cargo went by way of Liverpool in coasters, packed in casks or bags. The ocean liners having little water ballast were anxious to get the clay, and took it, at low rates, the through rate from Fowey to U.S.A. being sometimes as low as 7s. 6d. per ton. This was accepted in order to secure the weight for the steamers. Sailing ships also loaded direct. Cargoes 750 to 1,500 tons being the range, China Clay in bulk, bags, or casks and china stone. The fixture of one of these ships and their approach were events of much importance. The captains of these ships in those days were men of very considerable importance; and knew it. The ships were of various nationalities—American, German, Italian, Norwegian, as well as British.

(To be continued.)

Men in the Trade

Mr. T. Medland Stocker

MR. T. MEDLAND STOCKER, J.P., is one of the best known China Clay producers in the country. He is the son of the late Mr. T. Stocker, another of the early pioneers of this great industry, and founder of the world-famous firm of "The West of England China Clay and Stone Co." To record all what Mr. Stocker has been to the industry since his introduction to the business in 1893 would be no easy task with the limited space at our disposal, but he has certainly been a Napoleon in the China Clay trade. The mantle of responsibility was spread over him very early in his commercial career and he has practically been in a big way for at least a quarter of a century. Upon his father's death in 1901 he became the chairman and joint managing director of a huge business with an aggregate production of 120,000 tons per annum. His executive ability and faculty for organisation were soon recognised in the development of the many mines under his control, with the result that the firm's capacity within a few years exceeded 200,000 tons annually. The business continued to expand, until larger official quarters became necessary, and in the year 1908 those new offices which adorn one of the entrances to the town were opened. The subsequent amalgamation of the three large firms, The West of England and Great Bean China Clay Co., Ltd., of which Mr. Stocker was chairman, with the firm of Messrs. Martin Brothers, of Leemoor, and the North Cornwall China Clay Co., Ltd., was a vast undertaking, but the smoothness with which the English China Clays, Ltd. (the company which absorbed the three) is now operating, is a striking tribute to the commercial acumen of its leaders, Mr. Stocker, one of the three managing directors of this enlarged firm controlling a capacity for over half-a-million tons per annum.

Very few producers have been more alert either to penetrate the realms of science to find cheaper methods of production or to find new channels for the outlet of this ubiquitous raw material. He is personally acquainted with almost all of the home and foreign markets for China Clay, and before the war the firm had a most extensive connection with Russia. During the war Mr. Stocker was of great assistance to the War Office as a recruiting representative, and his services in this direction were warmly commended at Headquarters. Mr. Stocker was made a Justice of the Peace for the town of St. Austell in 1908, and is fulfilling the best traditions of the Stocker family by his practical interest in the philanthropic institutions of the town and district.

The Settling of Clay Suspensions

By Alfred B. Searle, Consulting Technologist to the Clay and Allied Industries

From a number of letters I have recently received from producers and users of fine China Clay, there appears to be a serious lack of knowledge as to what can be done to facilitate the settling of China Clay from its suspension in water, and I am, therefore, glad of this opportunity of explaining the matter somewhat more fully than in a recent article I wrote for The Chemical Age.

If any particles of powder which are insoluble in water are mixed with a sufficiently large proportion of water they will remain suspended in it for a length of time which depends on five factors :—

1. Their size.
2. Their shape.
3. Their specific gravity.
4. The temperature of the water.
5. The nature of the electrical charge (if any) on the particles.

If, to take an extreme case, the particles are large and globular with a high specific gravity and bear no electrical charge, they will rapidly sink to the bottom of the vessel in which they are suspended. If they are flaky they will require a rather longer time to settle than if they were cubic or spherical in shape.

The smaller and more spherical the particles the longer will they require before they settle out of suspension and the smallest particles may, under suitable conditions, remain in suspension for years !

We are accustomed to think of " still water " as being perfectly motionless, and forget that it is, in reality, composed of innumerable particles all in a state of ceaseless motion. The movement of these particles is not ordinarily visible, but if there is suspended in the water another substance, such as extremely fine particles of clay, which are sufficiently small to pass between the extremely minute particles of water then these clay particles will be subjected to an incessant bombardment by the water molecules and so will remain in suspension. Any clay particles which are large enough to resist such bombardment will sink to the bottom of the vessel, whilst the smaller particles remain suspended, just as a ball may be kept from falling by being tossed from one to another of a large number of players. This incessant movement of minute particles in suspension has long been known as the Brownian movement, being so named after the eminent botanist who first observed it in plant-fluids.

The power of insoluble particles to remain in suspension is still further increased, if each particle bears a definite electric charge. This is due to the property possessed by all bodies bearing a similar charge of repelling each other, whilst particles bearing opposite electrical charges attract each other.

This conception of an electrical charge on the smaller particles of clay appears to be very difficult of apprehension by many clay producers and users. So many of them fail to understand how particles of clay can be charged electrically when they have not been near to an electric battery or other " electric machine." To explain this apparent anomaly, attention may be drawn to a simple experiment : A shallow carboard box about ¾ in. deep is fitted with a lid made of clear celluloid and several small pieces of dry pith or tissue paper are placed in the box. The celluloid lid is then stroked gently with the hand in a circular manner ; after about a dozen strokes, the pieces of pith or paper will rapidly dance about and will continue to do so for a short time after the stroking motion has ceased. If we inquire into the cause of these dancing pieces we shall find that the box and its contents must be dry and warm and that the friction created by the rubbing of the celluloid must be appreciable. It is not necessary to use the hand, as a suitable cloth or piece of fur will do equally well. A careful and thorough investigation will show that although nothing appears to enter the box, yet that the rubbing of the lid imparts to it a feeble electric charge (electricity being " created " by rubbing under favourable conditions), and the charge is transferred through the air in the box to the small pieces of pith or paper within. The transference and the loss of the charge take place in an apparently irregular manner and this imparts the dancing motion to the small pieces of paper.

The manner in which pieces of paper are attracted by a fountain pen or a piece of sealing wax which previously has been rubbed with a piece of flannel is well known, and is also due to the transference of an electrical charge to the paper.

In both these cases, the electrical charge is " created " by friction and is then transferred automatically to any uncharged or oppositely charged particles which are sufficiently near to the article bearing the charge. Similarly, when any particles of a sufficiently small size are suspended in a liquid in which they are insoluble, they become charged electrically as a result of the friction to which they are subjected.

The best idea of small particles of clay suspended in water is gained if each particle is regarded as bearing a negative electric charge. When any such particle approaches another one similarly charged, they are prevented from colliding with each other because, as they both bear a negative electric charge, they are mutually repellant to each other. If, however, a negatively charged particle of clay were to approach a particle of another substance, bearing a positive charge, the two particles would be mutually attracted and would adhere to each other. In this way they would form a much larger particle and this, in turn, might be too large to remain in suspension, and so would, in time, settle to the bottom of the vessel. The composition of the positively charged particle is of no importance execept in so far as it affects the composition of the settled material. I have found, in the course of experiments, in 1913, for quite another purpose, that minute bubbles of air, each bearing a positive charge, form an excellent precipitant for clay. All that is necessary is to churn the suspension of clay in water in such a manner that positively charged bubbles of air are imprisoned by the moving liquid ; as these bubbles come into contact with the clay they unite with the latter and, by making a larger particle, cause the clay to settle.

There are many other means whereby positively charged particles may be introduced to a clay suspension. One of the simplest consists in adding a salt or acid which is readily dissociated in dilute solution into its constituent ions. Thus, in the case of hydrochloric acid (HCl) the constituent ions are the positively charged hydrogen ions and the negatively charged chlorine ions ; the latter are useless so far as the settling of clay is concerned, but they do no serious harm. As all acids produce positively charged hydrogen ions and the other (negatively charged) ions are useless, it does not matter what acid is used, so far as the settlement of the clay is alone concerned. When the use of the clay for various purposes has to be considered, some acids are preferable to others ; for instance, if sulphuric acid is used in slight excess, it may, when the clay is dried, char any organic matter present and so darken the clay. For many reasons, a weak acid, such as acetic acid or oxalic acid is preferable to a strong acid such as hydrochloric or sulphuric acid, but is usually more expensive. Salts and other substances which readily break down into their constituent ions, are equally satisfactory as precipitants or coagulants, but they may cause the settled clay to contain some of the added material which may interefere with some of its uses. For instance, calcium sulphate can be used, but the settled clay would be more fusible than if an acid were to be employed.

As the precipitation of particles of clay is wholly due to electrical causes, it is correspondingly easy to effect the resuspension of the clay merely by removing the charge which caused its precipitation and settlement. Hence, if acid is used to precipitate a clay and to cause it to settle, the addition of an alkali or an alkaline salt will cause the resuspension of the clay. No chemical compound is formed between the negatively charged clay and the positively charged precipitant ; the two particles adhere solely as a result of their electrical charges.

The rate at which particles of clay will settle out of apparently still water is directly proportional to their size. Consequently, if their size must not be increased by the adhesion of a particle bearing a charge of opposite sign, there is no means of causing the particles to settle ; they can only be separated from the water in which they are suspended by some system of ultra filtration or by evaporating the water by heat.

For many purposes, however, the size of a particle of clay united to another particle bearing a charge of opposite sign is still so minute that no possible objection can be raised to its use. When this the case, the addition of a suitable substance, followed by a period in which settling can occur, is the cheapest and best method of recovering the clay. If an unsuitable agent is added (such as is used to clarify some effluents where the suspended material is regarded as useless and a clear fluid is the chief consideration) the settled particles may be so large as to be useless for the purposes for which purified China Clay is generally required. A solution of alum or of aluminium sulphate is objectionable for this reason ; the alumina causes the formation of particles of clay and alumina which are too large to be satisfactory.

When only the very smallest particles of clay are required their settlement is often a matter of great difficulty. In the first place, the larger particles of clay tend, in settling to carry the smaller particles with them, so that only a small proportion of fine particles is left in suspension. Again, the smallest particles—even when their size has been increased by an adherent particle bearing an opposite electrical charge—are so small that the viscosity of the water in which they are suspended tends to keep them in suspension. This is a difficulty which cannot, apparently, be overcome, so long as water is the suspending medium. If alcohol or some other liquid of lower viscosity or lesser specific gravity were available at a sufficiently cheap rate, a much cleaner separation could be made, but, unfortunately, no such alternative liquid is, at present, practicable.

There remain two other alternatives : (1) The removal of the water by heat, which is far too costly, and (2) the use of an electric current which will, of course, cause the particles of clay, no matter how fine, to travel towards the anode and so accumulate to form a soft paste. This use of electricity is very costly, and it is doubtful whether it is worth while except for the very finest particles forming about 20 per cent. of the purified clay. Clay which has been transported in this manner by means of an electric current, retains the original sizes of the particles and does not contain any added ingredient ; the viscosity of the water is of minor importance, as the electric current passing through the suspension provides the power which carries the particles along.

Finally, it is important that to secure the best suspension or settling of a clay, the conditions must be controlled within very narrow limits. The maximum settlement occurs when the conductivity of the liquid and suspended matter is at a minimum, that is, when there are no surplus particles bearing an electric charge. For this reason, a serious excess of the precipitating agent should be avoided, only just sufficient being added to neutralise exactly the charges on the suspended particles. A description of the best method of determining this " optimum point " is outside the scope of this article, but enough has been written to show its importance, and the need there is for ensuring that it is reached in all attempts at settling clays.

In short, the problems involved in effecting the settlement of clay suspensions are typical of most colloidal suspensions and may be controlled in a similar manner. The great mistake made by many of those who are concerned with the settlement of such clay suspensions, is to try and work by " rule of thumb," which, in this case, gives very unsatisfactory results, because they have not learned to understand the principles underlying the causes of suspension and sedimentation.

China Clay and other Loading Materials

By "Paper Expert"

THE following is a list of mineral substances used generally in the paper trade as an addition to the pulp in the beating engine or as a surface coating for art papers. It is not correct to regard these materials in the sense of a " loading " to merely add to weight, since they fulfil other functions. But the term has been used from time immemorial and will probably last as long as clay or any other inert mineral substance is employed.

Agalite.—A silicate of magnesia containing 62·0 per cent. of silica, SiO_2 and 33·0 per cent. of magnesia, MgO, the remaining 5·0 per cent. being water of crystallisation and impurities. It is prepared for papermaking purposes by grinding, and when so manufactured has a somewhat crystalline structure. Imparts a smooth, glossy feel.

Aluminium Silicate.—The chemical name for china clay or kaolin.

Annaline.—A trade name for certain forms of sulphate of lime, used for loading or filling paper.

Asbestine.—A trade name applied to the less fibrous portions of asbestos ground down as a filler for paper. This is also a silicate of magnesia of slightly different constitution to agalite. It contains 38 per cent. lime and magnesia, 42 per cent. silica, 5 per cent. alumina and iron oxide.

Barium Sulphate.—A heavy substance with specific gravity 4·4. The natural mineral ground to powder is used in the paper trade under the name *Heavy Spar*. An artificial precipitated form prepared by adding sulphuric acid to soluble barium chloride is known by the name *Blanc fixe*.

Barytes.—The mineralogical name for natural barium sulphate.

Blanc fixe.—A trade name for precipitated barium sulphate.

Calcium Carbonate, or common chalk.—Used for special papers in limited quantity.

Calcium Sulphate.—See *Gypsum, Pearl Hardening, Sulphate of Lime.*

Chalk, Precipitated.—The chalk used in paper making is either the natural product suitably prepared, or prepared by precipitation of a soluble calcium salt with soda.

China Clay, or *Kaolin.*—A natural product formed by the gradual disintegration of *felspar* by exposure to air and moisture for many years. Specific gravity 2·5. The principal filler for paper used in large quantities, papers being loaded with it up to 25 per cent. in the case of imitation art.

French Chalk.—A form of silicate of magnesia, generally *talc*, finely ground. Has a smooth, oily feel, making it useful for well-made close sheets of paper.

Gypsum.—The name of the natural mineral known chemically as sulphate of lime, specific gravity 2·31. It contains 21 per cent. of water which, when driven off by heat, yields a dry substance of different properties known as *Plaster of Paris*. Both forms when finely ground to an impalpable powder are used as paper fillers.

Heavy Spar.—See *Barium Sulphate.*

Kaolin.—The mineralogical name for *China Clay*. The word is said to be a corruption of the Chinese word *Kauling*, meaning *High Ridge*, the name of a hill whence the material was derived.

Magnesium Carbonate.—A mineral prepared by the precipitation of a soluble magnesia salt and used chiefly for cigarette papers.

Pearl Hardening.—A trade term applied to the artificially prepared *sulphate of lime*. Chalk treated with a carefully regulated quantity of sulphuric acid gives this substance. It is much in favour for high class papers on account of its purity of colour. It has one disadvantage in that it is partially soluble in water, to the extent of one part of substance in 100 parts of water (distilled). Natural waters and backwater from machines may dissolve larger quantities under favourable conditions.

Permanent White.—A trade name for precipitated *barium sulphate.*

Plaster of Paris.—See *Gypsum.*

Powdered Plaster.—Powdered Plaster of Paris (see *Gypsum*).

Satinite.—A trade name for moist precipitated sulphate of lime. Not to be confused with *Satin White.*

Satin White.—An artificial product used for coating art papers, the constituents being precipitated alumina and sulphate of lime, prepared by adding slaked lime to a solution of alum in required proportions. An excess of free lime must be avoided, as otherwise the adhesive properties of the glue are affected.

Silicate of Magnesia.—The chemical name for the substances known under such trade names as agalite, asbestos, asbestine, talc, french chalk.

Sulphate of Lime.—The correct chemical name of the natural or artificial products sold under such names as *gypsum, pearl hardening, terra alba, crystal hardening*, and so on. It occurs abundantly in nature and is the cause of the permanent hardness of water.

Talc, or *French Chalk.*—See *French Chalk* and *Silicate of Magnesia.*

Terra Alba.—See *Sulphate of Lime.*

China Clay Notes and News

To Make Port Hope, Ont., Distributing Centre for English Clay

The Government is planning to deepen Port Hope harbour for the admission of ocean-going vessels, largely in the interests of the Bush English China Co., who have located here, and for the Pochin China Clay Co. of England. It is the intention of Messrs. Pochin to make Port Hope the distributing centre for America, if proper harbour facilities can be secured.

Varcoes China Clays, Ltd., Manchester

R. Grosvenor Varcoe, Director of Varcoes China Clays, Ltd., for North of England, who is also Director of Cornwall Porcelain Clays, Ltd., and William Varcoe and Sons, Ltd., which companies are indirectly connected, reports business in China Clay very fair. Barytes, the production of which they are connected with, has a fair demand. Whiting, of which they distribute a large quantity, the demand is good. French chalk, of which they are importers, there is a fair demand. They have just been appointed agents for one of the largest dry colour manufacturers in the country, and are also agents for Atlas Ultramarines.

Stocks of all these goods are kept at their local store in Manchester, consequently deliveries can always be made at a very short notice.

Drill Sharpener for China Stone

We understand that the English China Clays, Ltd., have recently installed a machine for the sharpening of drills for their China Stone Quarries at "Quarry Close," Nanpean. The machine is erected at their Hendra China Clay Works, the electric motive power being supplied by the firm's own power station. This innovation, we understand, not only reduces the staff hitherto employed in the smith's shop, but enables the firm to execute similar work for other China Stone Quarry proprietors in the neighbourhood and much cheaper than hitherto.

The English China Clays, Ltd., have certainly established a reputation for enterprise in the economising of the heavy productive costs of China Stone and China Clay.

English China Clays, Ltd.

Dividend on preference shares at rate of 7 per cent. per annum for half-year ended December 31, 1923, payable February 1 to shareholders registered January 23.

Accidents in China Clay Works

Accidents are very unusual in the clay works of Devon and Cornwall, but one occurred at the Criggan China Clay works near Bugle, belonging to the Consolidated Mines of Cornwall, Ltd., on Saturday morning, January 19, which terminated fatally. A clay-worker named Carthew, who was employed in the clay pit filling the travelling skip which takes the sand and other extraneous debris from the bottom of the works pit to the surface. As the skip was being drawn up the incline Carthew followed up the same road on his way to the surface for his breakfast. Just within a foot or two of the top the skip parted with the wire rope and it dashed down the rails with alarming velocity and into Carthew, who received such terrible injuries that he died after three hours' admission into the hospital at Bodmin. A verdict of "accidental death" was returned, the jury advising that the skips should be strengthened where they are fastened to the rope, and were of the opinion that it was dangerous for workmen to walk up the incline whilst the skips are moving upwards or downwards. In this case, however, they attached no blame to anyone.

Another accident occurred on January 29, at the Carbis Brick and Tile Works, when Frederick Howard Prynn lost his life through the falling of part of a new kiln. The accident in this case appears to be due to the abnormal rainy weather. A verdict of "accidental death" was returned, and in the opinion of the jury was caused by wet weather. An expression of sympathy was voiced by the jury and also the company with deceaseds' relatives in their bereavement

Canada as a China Clay Market

Within a year Canada will be the world's greatest producer of newsprint paper. This prediction is made by the Dominion statistician in a report on the pulp and paper industry of Canada for 1922, just issued. This report values the year's output at £31,157,077, an increase of more than £800,000 on the production of 1921. There were in operation, according to the report, 104 mills, of which 43 manufacture pulp only, 38 produced paper only, and 28 were pulp and paper mills combined. The quantity of pulp produced in the year was 2,150,251 tons, valued at £16,989,519. The production of paper and paper products totalled 1,366,815 tons, valued at £21,417,153, of which 1,081,364 tons was newsprint paper, valued at £15,154,265.

Fire

A very unusual occurrence happened at one of the large drying kilns of the English China Clays, Ltd., at Drinnick, near Nanpean, when the men were assembling on a recent morning, the roof of a kiln adjoining the colloidal department was observed to be on fire. The St. Austell Fire Brigade and their motor fire engine, under the direction of Captain T. J. Smith, were immediately summoned. Mr. T. Medland Stocker, one of the managing directors, together with Mr. A. Davies, the works superintendent, were also early on the scene in response to a telephone message. Fortunately, the men engaged on the works stripped the roof and were successful in extinguishing the fire before the brigade arrived and before much damage was done. The fire originated probably through the fusing of an electric wire.

The Enterprise of Clayopolis

At the recent St. Austell Rotary Club luncheon, Mr. J. W. Higman presiding, Mr. Sydney Grose, a local business man, opened a discussion on St. Austell and its critics from an enterprise point of view, and pointed out that they, the business men of the town, realised that the China Clay industry was not the only business in which capital could be profitably employed.

Dr. Newcombe Wright, who has been prominently associated with China Clay and other development schemes, said the progress of St. Austell was being hindered to some extent by the old men meeting proposals for development with the remark, "It's been all right for me," and not helping forward schemes. He referred to attempts he had made to get outside people financially interested in schemes, who pointed to the apathy of people locally and their disposition to depend on outsiders to find all the money.

Mr. H. Sydney Hancock, who has been prominently associated with the China Clay industry for many years, rebuked the critics, and controverted the suggestion that the old men had stood in the way of the advancement of St. Austell. Anyhow, he could recall numbers of people who had made their fortunes in the town and who were reluctant to leave it. He pointed to improvements in many directions as evidence that they had not stood in the way of advancement, though they had been handicapped owing to the smallness of their area, and in getting that enlarged they had not been helped by the young men.

Mr. James Perry, who has large interests in the China Clay industry, agreed with Mr. Hancock when he repudiated the suggestion that there had been any disposition on the part of the old men to stand in the way of progress. St. Austell in days gone by, under the guiding hand and motive force of Mr. Hancock, set the pace for a high standard of educational efficiency, and the institution of the County School and the technical centre in the town were monuments to his initiative and enterprise. As regards the China Clay industry, it was a mistake to suppose that it had experienced uninterrupted and unqualified success. During the period of the war and since, it suffered as perhaps no other staple industry in the country suffered, and even now there were some works who had not recovered their financial stability since the depression.

Mr. E. J. Hancock, another China Clay merchant, thought the reason St. Austell people, in common with Cornish people generally, did not succeed in combining their interests for mutual advantage was because they were extremely individualistic, and did not take kindly to "team work." He gave an illustration of this characteristic in the China Clay industry, in which all agreed that research work was necessary in the interests of the China Clay industry as a whole, but which firms preferred to undertake individually for their individual benefit rather than that the industry as an industry should undertake research jointly in order that the results might be available for all firms engaged in it. There were many things St. Austell lacked, including a central laboratory for China Clay research work.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Shipping—Fowey, January, 1924

Arrived.		Name.	Sailed.	Destination.
Dec. 1,	S.S.	*Suffolk Coast*	Jan. 4,	Birkenhead
Dec. 1,	S.S.	*Deneside*	Jan. 5,	Ridham
Dec. 1,	S.S.	*Isabella*	Jan. 5,	Ghent
Dec. 1,	S.S.	*Busk*	Jan. 8,	Gravesend
Dec. 2,	M.V.	*Katie*	Jan. 3,	Charlestown
Dec. 2,		*Mary Barrow*	Jan. 22,	Charlestown
Dec. 2,	S.S.	*Hayle*	Jan. 5,	Manchester
Dec. 2,	S.S.	*Heatherlea*	Jan. 5,	Runcorn
Dec. 3,	S.S.	*Pansy*	Jan. 4,	Preston
Dec. 3,	S.S.	*Sutton*	Jan. 8,	Runcorn
Dec. 3,		*Alert*	Jan. 17,	Runcorn
Dec. 4,		*Henrietta*	Jan. 10,	Mevagissey
Dec. 4,	S.S.	*Kofuku Maru*	Jan. 18,	Boston
Dec. 4,	S.S.	*Thure*	Jan. 9,	Bo'ness
Dec. 5,	S.S.	*Beeston*	Jan. 12,	Antwerp
Dec. 6,	M.V.	*Drogden*	Jan. 14,	Passages
Dec. 6,	S.S.	*Abercraig*	Jan. 8,	Par
Dec. 7,	S.S.	*Cervantes*	Jan. 12,	Genoa
Dec. 7,	S.S.	*Achille Bayart*	Jan. 16,	Rouen
Dec. 9,		*Vera*	Jan. 19,	Methil
Dec. 9,	S.S.	*The Viscount*	Jan. 17,	Larne
Dec. 9,		*Raymond*		*
Dec. 10,	S.S.	*Radnor*	Jan. 25,	Philadelphia
Dec. 10,	S.S.	*Cromwell*	Jan. 15,	Weston Point
Dec. 10,		*Leader*	Jan. 25,	Gloucester
Dec. 10,	S.S.	*Alberta*	Jan. 16,	Antwerp
Dec. 12,	S.S.	*Bombardier*	Jan. 18,	Bilbao
Dec. 12,	S.S.	*Ualan*	Jan. 16,	Nantes
Dec. 12,	S.S.	*M. J. Hedley*	Jan. 22,	Par
Dec. 14,	S.S.	*Moss Rose*	Jan. 16,	Weston Point
Dec. 16,	S.S.	*Estella*	Jan. 19,	Brussels
Dec. 16,	S.S.	*Broadgreen*	Jan. 22,	Antwerp
Dec. 16,	S.S.	*Falmouth Castle*	Jan. 19,	Runcorn
Dec. 16,	S.S.	*Suffolk Coast*	Jan. 19,	Liverpool
Dec. 16,	S.S.	*Halton*	Jan. 23,	Antwerp
Dec. 16,	S.S.	*Brier Rose*	Jan. 18,	Preston
Dec. 17,		*St. Michel*	Feb. 1,	Nantes
Dec. 17,	S.S.	*Sierentz*	Jan. 22,	Newport News
Dec. 17,		*Flying Foam*	Jan. 23,	Par
Dec. 17,	S.S.	*Pearl*	Jan. 26,	Runcorn
Dec. 18,		*Sif*	Feb. 1,	Copenhagen
Dec. 18,	S.S.	*Seaforth*	Jan. 24,	Lydney
Dec. 18,	S.S.	*Oxbird*	Jan. 24,	Gravesend
Dec. 19,	S.S.	*Vechtstroom*	Jan. 29,	Amsterdam
Dec. 20,	S.S.	*Mistley*	Jan. 31,	Antwerp
Dec. 21,	S.S.	*Florentino*	Jan. 24,	Genoa
Dec. 22,	S.S.	*Effie Gray*	Jan. 31,	Preston
Dec. 22,	S.S.	*Mersey*	Jan. 31,	Grimsby
Dec. 22,		*Rose*	Jan. 23,	Charlestown
Dec. 23,	S.S.	*Spaarnestroom*	Feb. 2,	Amsterdam
Dec. 24,	S.S.	*Hayle*	Jan. 28,	Newport
Dec. 24,	S.S.	*M. J. Hedley*	Feb. 1,	Preston
Dec. 25,	S.S.	*Calcaria*		*
Dec. 25,	M.V.	*Harjumaa*	Feb. 4,	Brussels
Dec. 26,	S.S.	*Achille Bayart*	Feb. 6,	Rouen
Dec. 26,		*Cornwall*		*
Dec. 27,	S.S.	*Westdale*	Jan. 27,	Weston Point
Dec. 27,		*Poseidon*		*
Dec. 27,	M.V.	*Neptunus*	Feb. 6,	Seville
Dec. 28,	S.S.	*Seaforth*	Feb. 5,	Runcorn
Dec. 28,	S.S.	*Lindenhall*		*
Dec. 30,	S.S.	*Cornish Merchant*	Feb. 4,	Ridham
Dec. 30,	S.S.	*Cromwell*		*

Par Harbour Shipping—January, 1924.

Arrivals

Date.		Vessel.	From.
Jan. 1,	S.S.	*Jolly Esmund*	Antwerp
Jan. 1,	S.S.	*Port Leven*	Plymouth
Jan. 1,	M.V.	*Carbid*	Falmouth
Jan. 4,	S.V.	*Emanuel*	Exeter
Jan. 5,	S.V.	*N.J. Neilson*	Truro
Jan. 7,	S.S.	*Abercraig*	Newlyn
Jan. 10,	M.V.	*Haldon*	Mevagissey
Jan. 11,	M.V.	*Katie*	Charlestown
Jan. 14,	M.V.	*May Blossom*	Fowey
Jan. 21,	S.S.	*Alder*	Guernsey
Jan. 22,	S.V.	*Flying Foam*	London
Jan. 22,	S.S.	*M.J. Headly*	Liverpool
Jan. 23,	S.V.	*Lord Devon*	Falmouth
Jan. 25,	S.S.	*Magrix*	Hull
Jan. 29,	S.S.	*Torpoint*	Penzance
Jan. 26,	S.S.	*Mango*	Plymouth
Jan. 30,	S.V.	*Naiad*	Truro
Jan. 31,	S.S.	*Inchbrayock*	Plymouth

Sailings

Date.		Vessel.	Destination.
Jan. 1,	S.S.	*Towey*	Penarth
Jan. 1,	S.S.	*Katherine*	Plymouth
Jan. 2,	S.V.	*Snowflake*	Weston Point
Jan. 2,	S.V.	*Amy*	Poole
Jan. 3,	S S	*Tanny*	Bristol
Jan. 4,	S.S.	*Jolly Esmund*	Charlestown
Jan. 5,	S.S.	*Port Leven*	Preston
Jan. 5,	S.V.	*My Lady*	Glasgow
Jan. 10,	S.V.	*Leader*	Gloucester
Jan. 11,	S.V.	*Fanny Crossfield*	London
Jan. 11,	M.V.	*Carbid*	Gloucester
Jan. 20,	S.V.	*Emanuel*	Bremen
Jan. 20,	S.V.	*N.J. Neilson*	Gravilines
Jan. 20,	M.V.	*May Blossom*	Plymouth
Jan. 23,	M.V.	*Haldon*	Gloucester
Jan. 23,	S.S.	*Alder*	Neath Abbey
Jan. 24,	S.S.	*M.J. Headly*	Fowey
Jan. 25,	S.V.	*Lady Agnes*	Queenborough
Jan. 26,	S.S.	*Magrix*	Teignmouth
Jan. 27,	S.V.	*Lord Devon*	Plymouth
Jan. 29,	S.S.	*Mango*	Fleetwood

Charlestown Shipping—January, 1924

Arrivals

Date.	Vessel.	From.
Jan. 3	*Hilda*	Fowey
Jan. 3	*Tynside*	Fowey
Jan. 4	*Jolly Esmond*	Par
Jan. 10	*Nalan*	Brighton
Jan. 19	*Camille*	Ferror Guires
Jan. 21	*Jolly Frank*	Exeter
Jan. 22	*Mary Barrow*	Fowey
Jan. 23	*Rose*	Looe
Jan. 24	*Isabella*	Teignmouth
Jan. 24	*Westdale*	Plymouth
Jan. 24	*Lady Daphne*	Truro
Jan. 25	*Moss Rose*	Penzance
Jan. 28	*Madeleine*	Cardiff
Jan. 31	*Linton*	Cowes
Jan. 31	*St. Austell*	Penryn

Sailings

Date.	Vessel.	Destination.
Jan. 2	*Tynside*	London
Jan. 5	*Jolly Esmond*	London
Jan. 10	*Myals*	London
Jan. 11	*Hilda*	Antwerp
Jan. 12	*Nalan*	Antwerp
Jan. 23	*Jolly Frank*	Rouen
Jan. 26	*Camille*	Granville
Jan. 26	*Mary Barrow*	Rochester
Jan. 26	*Rose*	Rochester
Jan. 26	*Isabella*	Granville
Jan. 26	*Westdale*	Preston
Jan. 26	*Moss Rose*	Preston
Jan. 30	*Lady Daphne*	Rochester

Penzance

Date arrived 1924.			From.	Loaded tons.	Sailed for.	Sailed 1924.
Jan. 4	S.V.	*Elisabeth*	Concarneau	396	Gothenburg	Jan. 7
Jan. 6,	S.S.	*Mellanear*	Hayle	354	Ellesport	Jan. 19
Jan. 31,	S.S.	*Onafors*	Bridport	310	Gothenburg	Feb. 2

Antwerp Arrivals

We give below particulars of arrivals of China Clay in the port of Antwerp during the month of January :—

From.				Tons.
Teignmouth	SCH.	*Confiance*	1/1	155
Fowey	S.S.	*Mistley*	3/1	500
Poole	SCH.	*Bidsie*	7/1	300
Teignmouth	SCH.	*Weser*	12/1	290
Fowey	S.S.	*Beeston*	12/1	450
Fowey	S.S.	*Alberta*	19/1	375
Poole	SCH.	*Devonian*	24/1	250
Teignmouth	S.S.	*River Deben*	29/1	187 & 1,266 bags.

January China Clay Deliveries

In consequence of the railway strike the China Clay deliveries for January suffered a set-back, the dislocation of mineral traffic rendering it impossible to get away cargoes with the usual despatch. However, the set-back was not so serious as might have been expected, the total for January being under 9,000 tons below the total for December. In 1922 January was the best month of the year, 74,000 tons having been delivered. The details of deliveries for last month are as follows :—

Port.	Tonnage.
Fowey (including china stone, 3,604)	47,448
Charlestown	3,603
Par (including china stone, 326)	2,495
Plymouth (including china stone, 48)	1,212
Penzance	1,060
Sent by rail throughout	4,617
Total	60,435

In addition to the above shipments, 1,282 tons of ball clay were sent from Fowey and 265 tons from Plymouth.

December, 1923, China Clay Deliveries

To the Editor of THE CHINA CLAY TRADE REVIEW.

SIR,—With reference to the article which appeared in the January, 1924, issue of THE CHINA CLAY TRADE REVIEW under the above heading, may I be permitted to state that from the statistics in my possession the total tonnage of China Clay and Stone shipped through Fowey during the year 1923 stands not merely as a post-war record but as the highest tonnage of this commodity ever shipped through the Port of Fowey.

The following figures might interest you.

SHIPMENTS AT FOWEY.

		Tonnage.
1912.	Highest pre-war	612,790
1923.	Port record	659,299

These figures include China Clay and Stone and Ball Clay. The 1920 shipments of China Clay and Stone, including Ball Clay, were 522,913 tons.

Yours faithfully,
J. R. CATHERALL.

China Clay Exports

RETURN showing the exports of China Clay, the produce or manufacture of the United Kingdom, from the United Kingdom to each country of destination, registered during the month ended January 31, 1924.

Country of Destination	Quantity Tons.	Value. £
FOREIGN—		
Finland	1,150	1,612
Esthonia	237	927
Sweden	1,261	2,729
Norway	2,045	3,454
Denmark (including Fare Islands)	451	1,282
Germany	1,580	4,386
Netherlands	2,376	6,221
Belgium	7,058	14,739
France	5,591	12,324
Switzerland	184	455
Spain	1,610	4,875
Italy	4,021	11,776
U.S.A., Atlantic	39,770	93,057
U.S.A., Pacific	1,423	3,196
Mexico	24	104
Brazil	6	34
Argentine Republic	300	1,424
BRITISH POSSESSIONS—		
Irish Free State	33	105
Other ports	2,315	9,203
Bengal, Assam, Bihar and Orissa	167	669
Victoria	12	125
New South Wales	10	51
Queensland	2	8
New Zealand	—	1
Canada	205	499
British West India Islands	2	8
Total, Foreign Countries and British Possessions	71,833	173,174

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

BRITISH ANCHOR POTTERY CO., LTD., Longton.—Registered January 7, £4,500 (not ex.) charge, to Bank; charged on British Anchor Pottery, Anchor Road, Longton. *Nil. October 11, 1923.

CARDIFF IMPERIAL PAPER CO., LTD.—Registered January 9, two mortgages, to Bank; charged on 5 and 6, and 6 and 7, Little Frederick Street, Cardiff, with machinery, etc., *Nil. February 12, 1923.

"DURUS" TILE CO., LTD., Birmingham.—Registered January 1, £2,000 debentures dated November 22, 1923 (by order on terms), to F. C. Austin, 30, Gravelly Hill, Birmingham; general charge. *——. November 26, 1923.

SAUNDERS (T. H.) AND CO., LTD., London, E.C., paper manufacturers.—Registered January 26, £2,500 mortgages, to A. Burton, Bank Chambers, Blackfriars Road, S.E., and another; charged on Wilmington Grange, Dartford. *£60,450. March 29, 1923.

SHRAFF TIP LTD., Stoke-on-Trent, china manufacturers.—Registered January 3, £15,000 debentures (secured by Trust Deed dated December 19, 1923); charged on lands, premises, etc., at Stoke-on-Trent, also general charge. *£15,000. April 9, 1923.

Satisfactions

BRITISH ANCHOR POTTERY CO., LTD., Longton.—Satisfaction registered January 14, £3,000, registered March 4, 1908.

CHADWICK & TAYLOR, LTD., Salford, paper manufacturers.—Satisfaction registered January 4, £3,880, part of amount registered March 18, 1922.

Companies Winding-Up Voluntarily

WHEAL BENALLACK CHINA CLAY COMPANY, LTD. John Keay, St. Austell, Chartered Accountant, appointed Liquidator.

WHEAL RETALLACK CHINA CLAY COMPANY, LTD. John Keay, St. Austell, Chartered Accountant, appointed Liquidator.

Partnership Dissolved

ERRINGTON REAY AND CO. (John McClare CLARK, William Harriman ALLAN, Sarah Isabella MacARTHUR, George REAY, John Rodger REAY, Elizabeth COOK), brick and tile manufacturers, Bardon Mill, in the county of Northumberland, by mutual consent as from January 11, 1924. Debts received and paid by G. Reay, J. R. Reay, E. Cook.

The St. Just Docks Scheme

THE promotion of the new docks scheme at St. Just seems to have taken on a new lease of life, and at a County meeting which was held at Truro, the advantages to be derived by the County of Cornwall were impressively advocated. The Mayor of Truro presided, and Mr. E. M. Howe detailed with much interest the history of the project from its commencement and which originated from a Cornishman, Mr. Julian Polglaze. Mr. Howe stated that if the new port developed it would prove of great benefit to the China Clay trade, and the administration would be more economical than any other port in the United Kingdom. Mr. W. Rose, principal of the firm of Messrs. North and Rose, China Clay merchants, of St. Austell, said he favoured getting the docks, but it would not be fair for the China Clay trade to take up a competitive system at St. Just or anywhere else while Fowey could handle more ships than were going there at the present time. The St. Just docks would meet a great want quite apart from the China Clay industry. In his opinion there was scope for ocean traffic and development of many other trades. The meeting gave their unanimous support to the scheme.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

New China Clay Companies

WE publish in this issue an account of what is described by some papers as an "Important New Enterprise in the China Clay Industry." This account deals with a large tract of territory on the Bodmin Moors, in which over 460 acres have been secured for the development of China Clay production.

This, of course, means work for many unemployed for some time to come as the removal of overburden and raising of kilns and plant must of necessity take considerable time before production can take place.

We are glad for the unemployed that work should be found, and as we understand that the company interested expect to have an annual output of some 30,000 tons of China Clay, this work should absorb a good deal of local unemployed labour. But is it not a fact that the present China Clay producers have difficulty in finding markets to keep their pits going? If this is so, we fail to see how, in the long run, the mutliplying of China Clay companies is going to benefit the community.

We would very much regret to see such over-production, and the old evils of price-cutting return.

The "Association" has done much to help the producer, and especially some of the smaller firms, who would have ceased to exist long ere this but for the help of the "Association."

The temptation to "break away" has already had serious results, and should we see a return to a war of prices which would result in the dissolution of the Association only the larger firms with sufficient capital would be able to withstand the onslaught. We view with considerable alarm the ventures of new companies into the China Clay trade.

Well established companies are having all they can do to hold their own, and clay sufficient to meet all demands. Further output may only add to present difficulties, and in the end revive the bad old days when every firm was "cutting" his neighbour and there was "nothing in it for nobody."

The employees as well as the employers have a real interest in seeing that those days do not return.

In view of the fact that present production is more than sufficient for the world's demands, we would seriously ask those who contemplate the opening up of further pits if it is in the interest of either themselves or the community to do so.

Foreign Competition

THE China Clay trade has shown signs of considerable improvement during the last year, and there is hope that this year may see an even greater increase in our home and export trade.

As a trade journal which has the welfare of the industry very much at heart, we have consistently advocated the superiority of English China Clays, but at the same time we have endeavoured to draw the attention of the producers to the ever increasing use of domestic clays by consumers abroad.

The Great War undoubtedly gave a chance to develop the production of foreign clays, and it was then found that with the improvements made in the micas and drys, and general production, the clays produced abroad answered the purpose of some of the paper mills and potteries, and those clays are still being used to the detriment of our English trade.

The Americans, as we have shown in previous issues of this journal, have increased their clay production nearly 60 per cent. over pre-war output, and this in spite of heavy transport costs from the Southern States. The writer found them being used in a number of factories in a recent visit to U.S.A.

It was, however, generally admitted that English China Clays were superior, and for the best class of work English China Clays would always hold their own.

Whilst this admission is satisfactory, as far as it goes, it clearly shows that greater effort will have to be made by English producers in producing at less cost their cheaper clays, and by this we do not mean by the reduction in wage of the workers.

In some industries this method of cheapening production seems to be the only one which comes to the mind of the employer, and is invariably wrong.

The better class English clays will hold their own, but it is a serious loss to lose the sale of our cheaper clays, and it is to this end producers must look if they are not to be ousted from the export markets in the near future.

New Uses for China Clay

CHINA CLAY, as readers of the "REVIEW" well know, is used in the filling and coating of paper.

The English, American and Continental paper mills use our English China Clay in large quantities, so also do the Potteries, though not to the same extent as the paper mills.

We have frequently drawn attention, both in Editorials and by specially written articles, to the many other uses in which China Clay can be utilised.

Readers who have already seen such references will, we are sure, forgive us if we once more draw attention to the many trades who employ China Clay in some form or other in the manufacture of their goods.

We recently compiled a list of over 50 known uses of China Clay, and this list must of necessity be incomplete

as frequently orders are sent to the producer who has no knowledge for which it may be used.

From enquiries which we have made we believe this list of lesser known uses is growing, and more especially since the advent of "Colloidal" clay. China Clay producers in the past have been content to supply consumers' orders without bothering very much for what purpose the China Clay would be ultimately used.

Experimenters with new processes of manufacture have sent for samples and prices of China Clay without being very clear themselves as to the quality desired. Frequently to them China Clay is China Clay and nothing more. They do not realise that there may be a hundred different brands of China Clay, some of which might have answered their purpose though the samples sent did not do so. The agents' answer to this is that it is very difficult to obtain information from a manufacturer of a new produce, as he does not wish to divulge information until it is ready for the market.

This, of course, is very true; but at the same time we think more friendly relations could often have been established if the agent had shown a greater willingness to help the enquirer. The days have gone by when the China Clay producer can adopt a "Take it or leave it" attitude. New and more vigorous efforts to capture trade have now to be made, and even if a large percentage of such enquiries prove to be abortive, some few of them may lead to the adoption of China Clay in large quantities in new manufactures.

This will only come about by closer co-operation between the enquirer and the agent.

Some of the larger firms retain in their works qualified chemists, who no doubt would be glad to put their knowledge at the service of such enquirers, and we believe that a little more help and persuasion on the part of the agent would often lead to the development of trade to their mutual interest.

"No order too large or no order too small to receive our best attention" might be a good slogan to adopt, and one which will undoubtedly do much to foster trade which is so badly needed.

We publish in another part of this issue an article on "China Clay and Petroleum" and also "Enamels Without Tin," and readers will see how China Clay enters into their manufacture.

We intend to publish from time to time similar articles showing how China Clay plays an important part in many products.

Freedom From Accident

THE China Clay industry is fortunately very free from accidents of any kind. Recently there has been recorded several fatal accidents in the China Clay works, and as these have happened so close together it has drawn attention to the facts; but the industry as a whole has been remarkably free from such distressing occurrences in the past, and there is no reason to think that the trade is any more dangerous than it has been.

An open air, healthy life has developed a fine class of workmen, and the lack of complicated machinery in the works has helped to make the China Clay trade very free from those distressing accidents to be found in so many other trades.

"Familiarity breeds contempt," and it may be that one becomes so used to the everyday work that one is apt to overlook the fact that even in an industry so free from accident dangers exist and must ever be watched for.

In no case has blame been attached to the firms where such accidents have occurred, and one can only express sympathy with the relatives of the unfortunate men who have lost their lives, and congratulate the industry that it is so free from accidents.

Defective Colloidal Clays

By Alfred B. Searle

UNFORTUNATELY, some of the firms now engaged in the production of what they term "colloidal China Clay" are not sufficiently well acquainted with the principles and the technique of the process they employ. Consequently, some of these "colloidal clays" which I have recently examined have been far from truly colloidal and do not differ in any way from the finer particles of clay which might equally well be collected in a much simpler manner. For although the underlying principles employed in the production of a high grade of colloidal China Clay are simple, there are many subsidiary matters which may easily and seriously affect the final product.

This may easily be seen by the simple expedient of stirring 50 g. of the clay with 1,000 c.c. of water, so as to bring all the clay into suspension, decanting the mixture rapidly into a tall glass cylinder about 2 in. diameter and allowing it to remain quiet for 24 hours. If the clay is truly colloidal in character, no settlement will occur, but much of the non-colloidal clay will settle out in this time. In making this test, care must be taken to use water which is free from any electrically charged particles—either of air or derived from soluble salts. Ordinary Kent well-water as supplied to a large part of London—for example, will precipitate a considerable amount of colloidal clay if used for the above test.

Fine Clay Not always Colloidal

There is an important distinction between finely divided clay and that which is truly colloidal, and it is of great importance that this distinction should be maintained, otherwise, we shall, in the near future, have very serious difficulties arising from the misuse of the term colloidal as applied to clay. Without going too deeply into the matter at present, it may be sufficient to say that any clay which settles out of suspension within twenty-four hours is certainly not in the colloidal sol state—which is what is usually meant when the term "colloidal" is applied to clay.

When this simple test is applied to several of the so-called "colloidal clays" now on the market, it will readily be seen how far short they fall of the implied definition. If they are examined more thoroughly—for example by means of an ultra-microscope—it will be seen that whilst they contain some active colloidal particles, for *all* clays do this, the proportion of such particles is extremely low. If a further test is applied and an attempt is made to estimate the actual proportion of true colloidal clay present, it will probably be found—as was the case with most of the "colloidal clays" I examined, that they contain less than 10 per cent. of active colloidal clay.

Causes of Failure

It would, perhaps, be unwise to publish a detailed statement as to the causes of the poor quality of some of these "colloidal clays," but the chief cause is undoubtedly summed up in the two words—faulty preparation. In some cases, the clays are so impure that the impurities present may be one of the causes of their low colloidal content. One sample contained no less than 12 per cent. of mica, which was readily separated by treating the clay with a very dilute solution of sodium carbonate, the minute flakes of mica being remarkably clean and well defined. Such a material cannot have been subjected to any treatment really suitable for the production of a high grade colloidal clay; it is inferior to some commercial samples of clay used for the manufacture of ultramarine, and I have examined samples of clay which were merely subjected to the action of a centrifugal machine, which were both purer and composed of smaller particles. Other samples consist of such coarse particles that it is difficult to believe that they have been prepared in any special manner; indeed they cannot be distinguished from China Clay of ordinary commercial quality as used for paper. Two samples appeared to have been carefully prepared, so far as the earlier stages were concerned, but to have been spoiled during the drying. One of these samples was—curiously enough—sold by one of the best known producers of colloidal clay. Still another

sample was either spoiled in drying or, as appears more probable, it was made of an unusually coarse-grained China Clay.

That there is little excuse for these defective materials is shown by the fact that with the exceptions of the three samples last mentioned, all those examined could be made to yield a very large proportion of truly colloidal clay when they were subjected to proper treatment. If this is the case with samples which had presumably been "prepared" and afterwards dried—which is always risky with colloidal sols—how much easier should it be to have obtained a much superior product by treating them at first in a proper manner.

When the first supplies of "colloidal China Clay" met with so cordial a reception, it was only natural that several China Clay producers should attempt to put a similar (or even an improved) product on the market, but the time has now arrived when some of the materials now being sold as "colloidal China Clay" should be sold under a true description—which is not the case when they are sold as "colloidal China Clay"—or the method of production should be so altered as to make them worthy of the name they bear. There is ample scope for several firms to supply colloidal China Clay of good quality, instead of some of the poor material represented by the samples mentioned above, and unless I am greatly mistaken, the production of a material of far better quality would not appreciably increase the cost of manufacture. It is, of course, extremely difficult to state, in detail, what should be done, without first making a careful investigation at the works themselves, but I have obtained sufficient information from the samples mentioned to convince me that a great improvement could be made in some of the samples by using very simple means. The details must, of course, depend on each works, and so cannot be given in an anticle such as this one.

China Clay and Petroleum

The Action of Clay

THE bleaching action of certain kinds of clay when thoroughly filtered, or, more precisely, dried to a rather high degree, has long been known amongst the oil refiners of Marseilles.

This action, which is apparently comparable, but only in results, with that of bone black, was quickly turned to account for refining mineral oils, and henceforth will claim considerable attention, though as yet this action is ill-defined, because the methods adopted are not really scientific. It is a well known fact that when properly dried and prepared a clay will absorb the usual colouring matter of petroleum, but the mechanism of this bleaching action is not yet known.

Moreover, there are two different and very special methods of work for the use of a China Clay to refine petroleum. The first relates to the bleaching of very fluid oils only slightly coloured, such as the products from the initial stages of distilling crude petroleum before or after refining. The second is for treatment of fats, thick at the ordinary temperature and highly coloured.

Bleaching by Agitation of Oil with the Clay

In the first case the operation is very simple. It consists in throwing into the mechanically agitated liquid specified quantities of the pulverised clay, previously desiccated in apparatus where the temperature can be raised to 300° or 400° C. (572° to 752° F.) without inconvenience. The dust can also be blown into the liquid with a current of air.

When the oil has been kept in motion for a certain length of time the agitator is stopped. Then being left in repose the clay quickly settles down. When well made and sifted to separate the dust the clay will deposit very quickly, giving a very clear liquid which need not be filtered. In the contrary case, or that of a clay with very peculiar texture, the oil must finally be filtered either on ordinary filters or press filters. As a rule the clay is separated from the oil either by decantation and subsequent filtration of the oil, the deposit being removed by hand or machine, or by decantation to a suitable level corresponding with the quantity of residual liquid necessary to transform by further agitation the deposit into a sufficiently fluid slime to be conveyed by gravity to the filters, or even pumped for press filters.

Drying the Clay

Any kind of dryer, fixed or rotary, where a temperature of 300° C. to 400° C. is attainable can be employed.

The bleaching action is naturally heightened by heating the oil, which makes it less viscous and favours decantation. Temperature of the oil does not seem to affect the bleaching power of the clay. On the one hand it has been found in practice that the effect is better when the clay is thrown into warm oil. In this way bleaching is quicker and cost of the material less. On the other hand no great difference was noted in results obtained by adding the clay in parts, followed by decantation, and putting all the clay in small quantities into all the oil at once. In this case the action of the clay seems to be instantaneous, and there is between the clay and colouring matter a certain selection corresponding to a kind of classification, the first parts of the clay successively attacking the colouring matter, which has a greater affinity for clay than that remaining in solution.

This property explains the possibility of utilising clays already employed for bleaching a second time.

The Mechanism of Bleaching with Clay

To give an idea of this rather curious phenomenon some explanation must be given to simplify the problem. For this we shall suppose that there are three volumes, V, of the same colourless distillate, which we shall also suppose to be coloured:

1. With a quantity *a* of substance A.
2. ,, ,, *b* ,, B.
3. ,, ,, *a* of A and *b* of B.

We can demonstrate by experience that these distillates will require for bleaching quantities of clay respectively equivalent, in the first case to Qa, the second Qb, and the third Qa+Qb=Q.

This seems normal at first sight, but let us now suppose that instead of adding to the volume of distillate, V, coloured with substances A and B, the quantity Q=Qa+Qb of necessary clay for total bleaching, we only add a quantity Q^1 smaller than Q. What will occur?

Evidently the petroleum obtained will yet be coloured, but with what? With two substances A and B, or one of the two?

To answer this question it may be said that practical work demonstrates that, as a rule, there is a selection of one of the colours by the clay, which will saturate the successively added portions of clay, whilst the second colour is not absorbed until the first has totally disappeared.

Thus if the substance A disappears first B will not be absorbed until after adding to the volume V a quantity of clay Q^1 greater than Qa, viz., greater than that for complete saturation of the clay with colour A.

Briefly, bleaching with clay takes place with successive and not simultaneous effects. This explains why certain coloured distillates which require very little clay to change from a brown to a light straw colour require considerably greater quantities for final bleaching. This very important fact demonstrates that a clay with very active bleaching properties in the case of some highly coloured oils will have no effect on very lightly tinted oil the colour of which is caused by different impurities due to some other method of manufacture.

This bleaching power of clay can also be practically utilised provided that work is methodically conducted and not simply by adding all the clay at the same time.

Let us return to the previous example of a petroleum coloured by two substances, A and B. As we said, to bleach such oil, quantities Qa and Qb of clay must be added in small portions. Supposing that when Qa has produced its effect it is removed after depositing so as to be able to utilise Qb to act on B in the absence of clay staurated with A.

If when saturated with this substance B, after the second treatment, we take away the clay, we shall find that when added to petroleum it will liberate the substance B with which it is saturated and absorb substance A for which it has greater affinity. In many cases this previously used clay will bleach the distillate to a considerable degree. The affinity of a clay for colouring matter seems to be in accordance with the colouring power of the substance, viz., the most intense colouring matter is the first to be absorbed by the clay.

China Clay Developments in North Cornwall

As we intimated a few months ago, a new and very important development in China Clay production is about to be commenced in the Bodmin area of Cornwall. It has been asserted more than once by old experienced men that the North Cornwall district will eventually become the great industrial zone of China Clay activity. The mines which have have been already opened up have proved beyoud all expectation and doubt as to their value and productive capacity.

It is understood that a newly-formed company have secured an immense clay-bearing tract of land extending to nearly 500 acres from Sir Roger Onslow, and an early movement is expected in the commencement of operations. This underlying clay land has been attested and plans for production on a large scale have been decided upon. There will be three new drying kilns, each 300 ft. in length, with settling tanks, settling pits, micas, and a six-mile pipe line, which will afford considerable employment in the district between Bodmin and Camelford, and when completed will have an output of over 35,000 tons per annum. There appears to be a tendency toward the opening up of larger pits with centralised plant and connecting China Clay drying kilns. The advantage of this is that a more efficient and technical staff could be permanently engaged, where in the case of single and smaller sites it would prove too expensive. One foreman could as well look after several dries as one. No doubt the next few years will witness far greater developments than the industry has yet seen. It will be remembered that the renowned " North Cornwall " or " Stannon Moor " is within the estate of Sir Roger Onslow, and if this distinguished baronet succeeds in the disposal of his lands adjoining for similar exploitation he is to be congratulated, and it will mean considerable employment for the neighbourhood. This announcement will naturally recall the present extensive operations of the " Stannon Moor " pit, which is almost under the shadow of Cornwall's loftiest ridge, known to geographical students as Rough Tor, an aretæ that is 1,296 ft. above the level of the sea. It was just 23 years since the serenity of the rural life of these moors were penetrated by a couple of St. Austell gentlemen, Mr. W. R. Nicholls and the late Mr. F. J. Gaved, and the North Cornwall China Clay Co. formed. This company, thanks to the energy of Mr. Walter Sessions, who later became managing director, developed into one of the finest China Clay works in the industry, producing clay which has become world famous. After some years this firm amalgamated with two others, and became the property of English China Clays, Ltd. A very modern and up-to-date plant is being worked there at present.

The power station at Stannon is designed and equipped with a modern plant which not only ensures a continuity of supply, but sufficient power for future extension. There is a double 16-in. pump with an alternating stroke of 7 ft., with an average of seven and a half strokes per minute, raising 850 gallons of liquid clay per minute. The micas and settling pits are well constructed and form quite an interesting feature to the casual observer and a source of admiration to those engaged in the trade. The liquid clay is then conveyed by pipe line to Wenford, a distance of seven miles, where the English China Clays, Ltd., have six of the largest and best equipped kilns in the industry. The total length is 1,700 ft., with a drying of 75,000 tons per annum, and alongside the mineral branch railway line. Each kiln is specially designed not only for the economic consumption of coals, but in the provision of every facility for storage and prompt despatch. At the rear of these kilns there are 35 huge stone-built settling tanks capable of holding at least 24,000 tons of clay, with the water either evaporated or drawn off to the consistency of cream, which is easily trammed into the kilns and dried into convenient blocks for disposal. There is a treble line of earthenware pipes from the works to the kilns. The operations at the kilns and also in connection with the loading are quite distinct from those at the pit, but the telephone keeps all in close touch with the progress of each section and also the head office. There can be no doubt that the Bodmin Moors have produced some excellent clay, but we would refer our readers to our editorial as to the advisability of opening up fresh pits at the present time.—(EDITOR.)

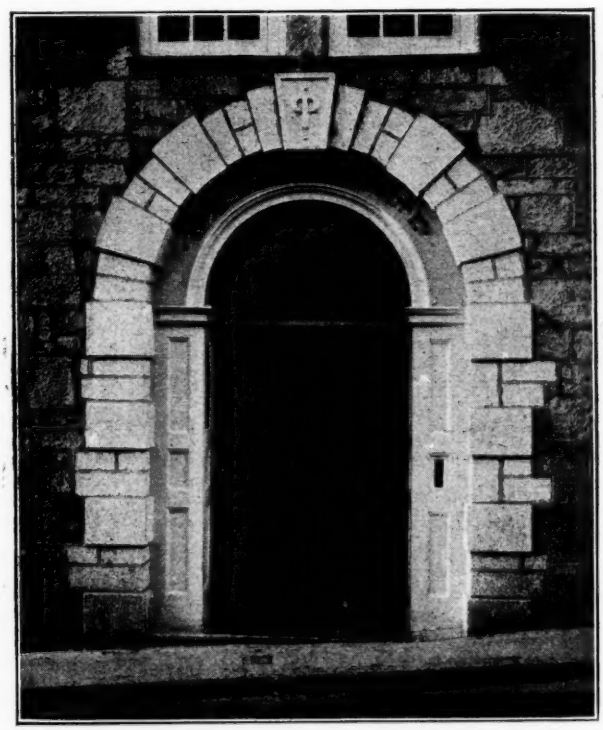
Looking Backward

ONE of the oldest Cornish weekly newspapers, *The Royal Cornwall Gazette*, in its recent issue recording a brief *résumé* of happenings fifty years ago, stated that the China Clay industry in the neighbourhood of St. Austell was in a very prosperous condition. The prosperity of the industry in those days compared even with the past year's consumption is remarkably instructive. For example, the output in the year 1872 was only 141,000 tons, and by 1877 it only reached the yearly production of 200,000 tons. Notwithstanding the great European crisis which has disturbed all industrial concerns throughout the world, as well as the competitive production of domestic clays in so many other countries, the consumption of English clays was very nearly 800,000 tons last year, which should be sufficient to enhearten all associated with the trade. In going back so many years there must be comparatively very few in either Devon or Cornwall who can give a retrospect of the industry before the introduction of the steam engine or any kind of mechanical appliance. In fact, a hundred years ago the output hardly necessitated any machinery, although there must have been even one or two coal-drying kilns and even one or two pumping engines in the neighbourhood. It has been the writer's privilege to have had the acquaintance of a couple at least of very earliest pioneers who were just able to convey a glimpse of those crude productive days. One of these old pioneers, who lived to be over 90 years of age, was employed in a China Clay mine, where the virgin clay was dug out of the pits and conveyed in hand-barrows to primitive wooden troughs, where the clay would be washed. It must have been a most difficult and laborious operation to remove the impurities, but no doubt in those days manufacturers were not so fastidious as they are now with regard to their samples, or the standard of refinement of the product was not required as it is to-day. There were some mines where the washing was done in the pits and the liquid clay pumped up to the surface by those familiar hand pumps. Clay was principally dried in the open-air tanks during the summer months and placed in improvised sheds and linhays where the air gave it a finishing touch. The final stage of production was the scraping of the lumps, which were usually in squares, an operation principally done by women. Women at that time predominated on the staff and worked for about 8d. per day, whilst men received from 1s. to 1s. 6d., and one or two foremen might get as much as 2s. per day, and apparently with as much contentment as exists at the present time. The trade began to develop before there were any facilities for transmission. With no railway in the county clay had to be carted either to Pentewan, Charlestown, or Par, and this operation often occupied the local carriers long days. The roads were not macadamised, and in the St. Stephen's district it has been said that when these wagons once got into the rut, as it was the only thing they could do, they experienced the greatest difficulty to get out of it for miles at a stretch. In the hungry 'forties other pioneers of the industry followed up the development of the great pottery enterprise which had begun to forge its way in Staffordshire, whilst others proceeded to the United States, opening up China Clay markets there to the benefit of the community at home. During the past half-century roads have been improved, and practically nearly every work of any importance is either linked up with the main line or one of the many branches which form such a rail network in the district.

The introduction of steam power revolutionised the industry, especially the Cornish pumping engine, which has rendered such great service in the development of the mines, but now oil, gas, and electricity have superseded it. The winding machinery has advanced considerably, and the incline wagons are now being drawn up to the surface from the pits' bottoms with the utmost rapidity. In the drying of clay the past year showed remarkable progress with the inception of oil fuel, which is now being adopted with success, and from the United States comes the announcement that coal dust gives a greater drying capacity than any other fuel, and is far cheaper. With the rate of progress maintained another half century, or even quarter of a century, a greater extension of the China Clay trade than has yet been recorded may be anticipated, but whether for good or for ill for the trade as a whole remains to be seen.

Alteration to Messrs. Pochin's Offices

THE photograph which we have very much pleasure in publishing of the front entrance to the St. Austell offices of Messrs. H. D. Pochin and Co. is but a small portion of the great scheme of improvement effected by this enterprising China Clay producing firm in connection with their central offices at St. Austell. The offices are situate opposite the new Post Office in High Cross Street, a position unsurpassed for prominence, as is evident by the fact that several other important offices are located in the same street, including Lloyd's Bank. It was originally intended to erect a new suite of offices commensurate with the business prestige of the firm, but after consultation with the firm's own architects, Messrs. Easton and Robertson, of 36, Bedford Square, London, W.C., it was decided to



MESSRS. H. D. POCHIN & CO., LTD., OFFICE ENTRANCE, ST. AUSTELL.

modernise the existing building which was erected nearly 120 years ago. Inside the front entrance there is a large and easy ascending staircase to the various clerical departments, including the Local Director's office and the shipping department, and on the ground floor there is a general inquiry office and telephone on one side and a large general clerical office on the other. The front entrance has been much commented upon and provides quite a new feature in architecture. The bold granite archway, with the firm's own crest in the centre, is relieved by panelled pillars of a special composition applied in a similar way as cement, which renders the work neat and attractive. On either side of the entrance are the firm's business plates, which are also a novelty, composed of China letters inserted in bronze. The new offices are under the supervision of the Local Director, Mr. J. W. Higman, junr., and the firms controlled are the Wheal Remfry China Clay and Brick Co., the Mainbow and Newbridge Ball Clay Co., the Park China Clay Co., the McLaren China Clay Co., as well as the several China Clay mines of Messrs. H. D. Pochin and Co. and the Cornish Hosiery Co.

It is evident that the operations of the firm of Messrs. H. D. Pochin and Co. in the West are very heavy, and require modern methods of business commercially as well as in production to enable the firm to maintain their high reputation. The work has been very satisfactorily carried out by Messrs. F. A. Prophet and Sons, St. Austell.

Enamels Without Tin

China Clay's Use

WHITE enamels can be made with antimony oxide, arsenic, bone ash, cryolite, a mixture of felspar and fusible spar (flusspat) and finally zirconium oxide (zirconia) instead of expensive tin.

Antimony oxide gives fairly pure opaque white enamels of great brilliancy.

Arsenic also produces a fine opaque enamel, but less tenacious, and it burns at high temperatures.

Bone ash gives a very adhesive product, but it readily absorbs soot.

Better results are given by cryolite (double aluminium and sodium fluoride) which, however, can be replaced with a mixture of felspar and fusible spar.

To make a cryolite enamel the former is mixed with quartz sand in the proportion of 1 for 2 or 3. To obtain better adhesion and harmony in expansion with the clay to be enamelled, minium, zinc oxide, lime, or a substance giving the same effect, is added. The complete mass is fused or well fritted and crushed.

According to experiments made by Budnikoff at the Polytechnic University of Ivanovo-Voznesensk (Russia) excellent results can be obtained by incorporating a ziconium compound, oxide or hydrate with the enamel. A very fine opaque white is already obtained with 5 per cent. zirconium oxide, and yet better results are given with a mixture of tin oxide and zirconium oxide. The following are two compositions made in this Institute :—

I.	Parts.
Zirconium Oxide	5
Minium	34
China Clay	10
Calcined Soda	14
Calcium Carbonate	1
Zinc Oxide	1
Quartz Sand	35

II.	Parts.
Tin Oxide	7
Zirconium Oxide	3
Minium	32
Quartz Sand	35
China Clay	10
Calcined Soda	12
Zinc Oxide	1

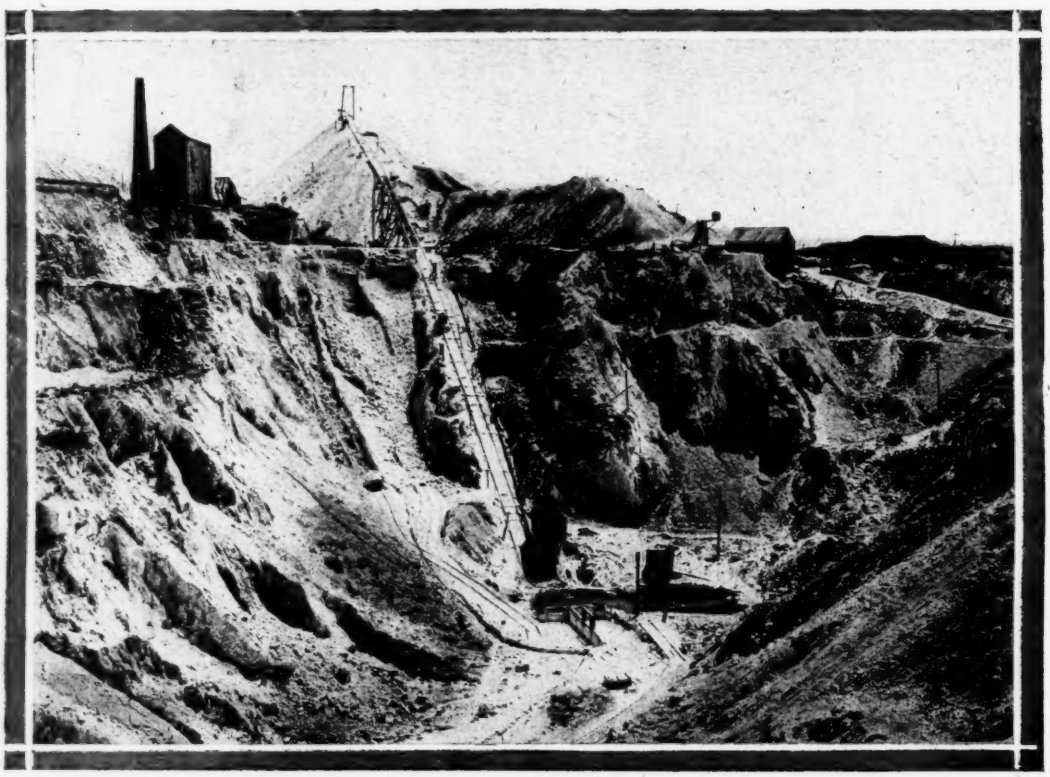
All is melted, run in water, and crushed.

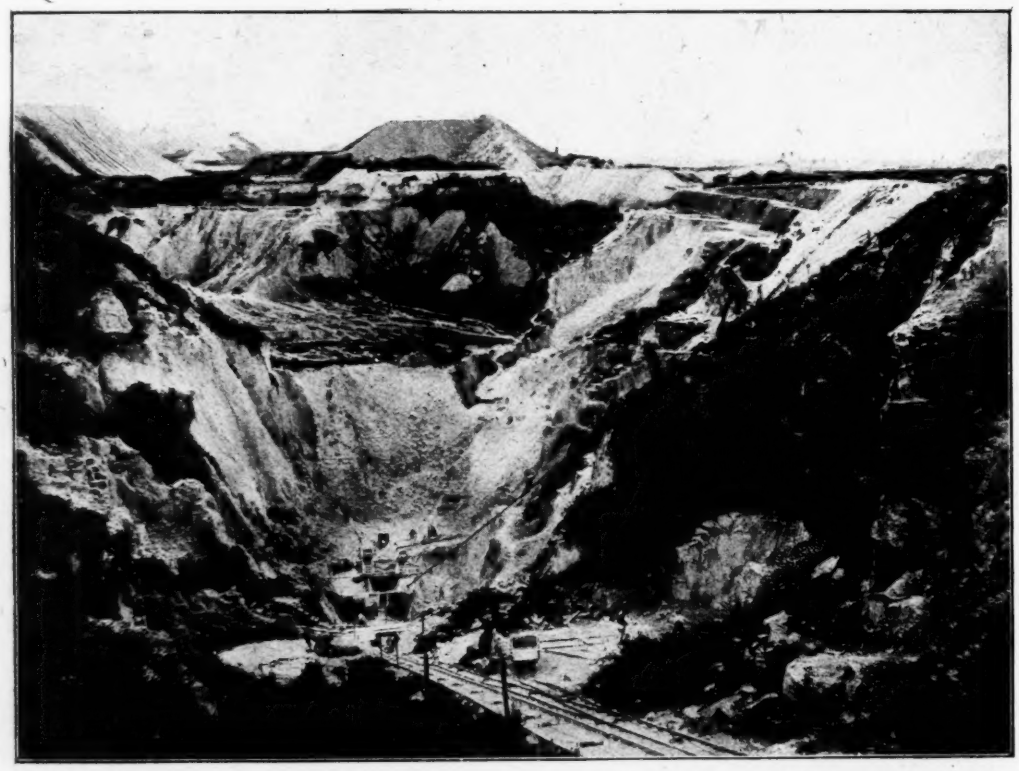
Men in the Trade

Mr. F. J. Lovering

MR. LOVERING is a son of the late Mr. John Lovering, founder of one of the premier firms, Messrs. John Lovering and Co. Our subject was born at St. Austell and his early education and training distinguished him for a high medical career. This, however, he forsook in order that he might devote his attentions to his aged father, whose illness had been regarded by eminent physicians as hopeless. This early devotion on the part of our subject gave the late Mr. Lovering quite a new lease of life, and he lived to the ripe age of 88 years. Mr. Lovering was at one period interested in the public life of the town, and as a member of the St. Austell Urban District Council he proved to be an acquisition which any town might well be proud of. Although he has not taken such a prominent part in the business of the renowned firm associated with his name, yet he is one of the largest shareholders and has naturally taken a keen interest in the China Clay trade generally. One of Mr. Lovering's favourite pursuits in the past has been in the collection of fine art, and it would be very difficult to find even amongst the best connoisseurs in the West of England a more valuable selection of early English furniture and antique china than that possessed by the subject of this sketch.

Mr. Lovering resides at Caprera, St. Austell, a beautiful and commanding residence built by his father some 60 years ago.





Two of the Clay Pits of ENGLISH CHINA CLAYS, Ltd.

Fowey

By John P. Carter

THE chief development in the clay shipping facilities at Fowey has been the erection of a conveyor belt at No. 4 jetty, and a new jetty to carry two sets of conveyor belts and tips, and two cranes at No. 8. To find siding room for these, the hill at the back of the jetties has been cut away until now a bank of about 50 feet in height is reached.

Thinking back to the time shortly after I came to Fowey, I am of the opinion that the dockers worked so hard and so long that they perhaps lead us to expect too much of them. They also let us know of what could be done at each of the old jetties in an hour or two at low tide, *i.e.*, when the ships were low enough for the clay or stone to run freely down the shute. Now a kindly union watches over them and regulates their labours and hours, and presumably their pay, and at the same time puts a limit on the output.

In the earlier days, the week's work started at 2 a.m. and continued until 10 p.m., two twelve-hour shifts per day, less meal times. I don't know how they were paid; that was always a mystery and is still. We heard references to the "old pairs," "the pool," "ton money" and "day men," but being satisfied to leave that to the kindly Railway Co. who arranged these mysterious matters for us, we never attempted to probe too far. Many of the old hands are still on the jetties, being gradually promoted to the more responsible positions, and a fine lot of fellows they are, too; nobody can beat them at their own job.

The ships pay for their portion of the work by the ton at a regular tariff rate charged by the Railway Co.—a very moderate rate for the smaller ships, which increases in rate per ton as the size of the ships increases.

The dockers know their job and take quite a pride in it and at times do some very smart work, when they feel like it, but won't be driven to it.

The freeing of the Saturday afternoon was a great boon to all jetty workers and I must admit to me, too, as I thoroughly enjoy that half day; though it was perhaps not so appreciated by the shipowners generally, especially as it meant reducing our working week to five days four hours.

The Great Western Railway Co. have done a great deal of work and must have spent huge sums in extending the siding accommodation and improving the shipping facilities. To extend the sidings, great slices of an ever-rising hill have had to be removed to push back the Lostwithiel line. This formerly went through a cutting at the corner near the No. 4 jetty, thus forming "The Island," as it was called, between the line and the corner. This was also gradually removed and made such a wonderful difference to No. 4 jetty, and the approaches to No. 5, 6 and 7 jetties beyond the corner. The height of the sliced face of the hill is now not less than 50 feet and must have caused millions of tons of earth and stone to be removed. A recent land slide of 1,000 tons could not be noticed unless pointed out to one!

The jetties 1, 2, 3, 5, 6 and 7 have been very little altered or improved, except for periodical renewal of their structural timber—the pine which is so enjoyed by the tropical worms, which quickly riddle them with their wonderful borings.

No. 1 jetty has a hydraulic tip and steam crane, capacity 75 tons an hour, bulk clay and stone, or crane about 20 tons an hour. One turntable tapping one line.

No. 2 jetty is similar to No. 1, except for two turntables tapping two lines.

No. 3 jetty similar to the 1 and 2 for China Clay, but no stone, as its shute is not iron lined. Crane and tip cannot be worked together on either of these three jetties.

No. 4 jetty was formerly like No. 2, suitable for stone or clay, and being about 300 feet from No. 3 was generally reserved for the larger ships, as 1, 2 and 3 are only about 200 feet apart, the former capacity say 100-ton bulk and 20-ton crane.

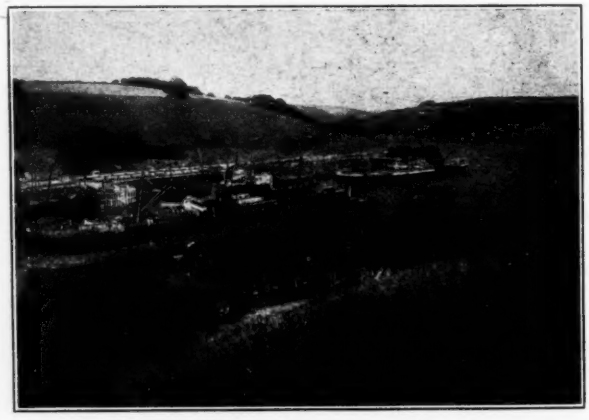
No. 5 and 6 jetties are around the corner facing Mixtow. Small jetties with a single crane each, capacity for loading or discharging about 20 tons an hour.

No. 7 jetty is a larger jetty with two cranes for loading or discharging. Capacity about 40 tons an hour.

On No. 4 jetty a conveyor belt was erected in 1909, worked by electric power, from a silo fitted near the shore end of the jetty. This was a very simple arrangement but made a great difference to the despatch of the larger ships, which, by means of this conveyor, could be loaded at all states of the tide. It has a capacity of over 200 tons an hour for bulk clay; and one electric crane about 30/40 tons an hour. In actual practice this jetty regularly maintains a rate of 100 tons an hour, notwithstanding time lost for shifting ship. It has three turntables tapping about six lines. In fact, it does so much work that it blocks the jetties with empties from end to end, unless there is an engine handy to take them away for more clay.

No. 8, the new and now somewhat famous jetty, is a very finely constructed wharf where ships to a depth of 28 feet can lie afloat at low water, rests on 22 steel concrete filled cylinders, most of which went to a depth of 70/80 feet before finding solid foundation. The loading machinery of this jetty is of very elaborate design, intended to operate two tips and two electric cranes, the belts being designed to ship stone as well as clay, each tip being fed by a set of five belts only one tip and one crane being yet in commission. The single tip is capable of shipping 200 tons an hour and the electric crane 10 tons. The design is rather ingenious, to enable the portal structure carrying the tips to be moved the length of the jetty and tip in any hatch of the ships of not over about 335 feet length, too short unfortunately for the 400/450 feet length modern ships that come here, without moving them back to get at No. 1 hatch.

This jetty can do the tipping all right with suitable clay, as it has done it, for an hour, we have seen it; then, thanks to the designer of the railway line connections, the next hour



JETTIES NOS. 2, 3 AND 4 AT FOWEY.

or two is lost clearing the empties and looking for the next lot. An engine and shunters are needed in constant attention. More time is also lost to the ship, men and jetty for want of communications, for messengers to be sent to and fro. Our Railway Co. are very conservative and will not erect such a modern necessity as a telephone, presumably unless they find in the next year or two it will really be an advantage. A telephone box on the jetties connected with the National has recently been granted for the use of one China Clay company and the Fowey shipping agents.

In the matter of shelters, too, the Railway Co. are very careful, especially towards shipping agents and others who may have the privilege of doing business on their premises. I have had this privilege for many years and have not yet discovered one except by trespassing in one of their department's huts.

I have, however, always received the greatest courtesy from the various officials in whose premises I may have from time to time sought shelter.

Mr. Glasson, the present stationmaster and railway representative, is a most capable, methodical and courteous man, and certainly knows his job, too, and I fancy all the railway regulations and tariffs that were ever issued—certainly all connected with Fowey. But the railway being a big concern, he has to act in accordance with these regulations and limitations. He has with him also most efficient staff. We are fortunate

in having Mr. Nimmo in charge of the electric power and machinery, it being due to his care and attention we have so few stoppages.

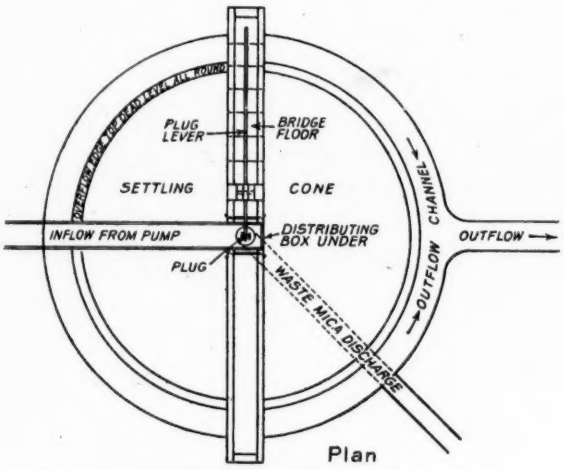
Referring again to the jetties and their hourly capacities, this shows a very large shipment as possible, and to which I think we can attain. Presuming we take 50 per cent., it works out as follows :—

No. 1 ..	75 or 20	50%	—	37½ or 10
No. 2 ..	100 ,, 20	,,	—	50 ,, 10
No. 3 ..	100 ,, 20	,,	—	50 ,, 10
No. 4 ..	200 ,, 40	,,	—	120
No. 5 ..	20	,,	—	10
No. 6 ..	20	,,	—	10
No. 7 ..	40	,,	—	20
No. 8 ..	200 and 10	,,	—	105
Total per hour,				402½ tons, say 400 tons.
For shift, 8 hours, at 400 tons				3,200 ,,
For day, 2 shifts				6,400 ,,
For week, five days four hours				33,600 ,,
The reserve belt and second tip at No. 8 could add, say				8,500 ,,
And a third shift, say				10,000 ,,
Would give a possible expansion to, say, weekly				52,100 ,,

Our present record is around about 18,000 tons a week.

It will be seen, therefore, that Fowey can accommodate, with present facilities fully developed, more than double to-day's output.

I hope to write next month about ships that visit Fowey.



Refining China Clay

Coon's Elutriating Pit

THE sand and other coarse aggregates forming the China Clay rock are easily and readily separated in the sand pits and mica drags in the bottoms of the pits. The remainder of the aggregates—*i.e.*, kaolin fraction, finer mica, tourmaline, etc.—is pumped with the stream of the water to the surface and enters the main mica drags for further refining. The entrance end of the drags is usually of semi-circular shape, bears the name of the " Round Head," and forms the first sedimenting area where the coarsest of the material from the stream is deposited, if it has sufficient capacity to slow down the stream for this to take place. As a rule, however, its capacity is so limited that it does not accomplish the end, and a great deal of what should be taken out at the entrance of the micas flows on and fills the channels which would otherwise be available for separating the finer ingredients.

The coarse sediment in the " Round Head " is washed through a plug-hole to the waste stream, and the same means are taken to get rid of the settlement of the mica channels except that the finer portions are re-washed for a lower grade of clay.

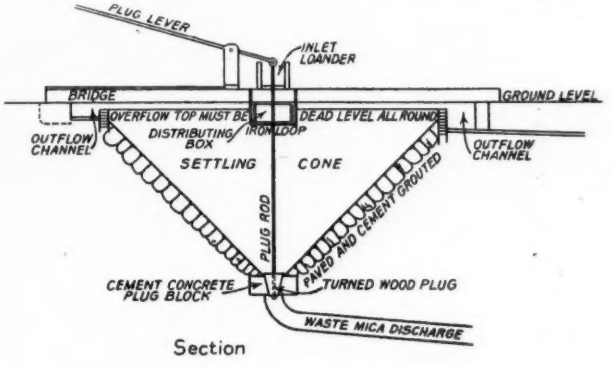
About 20 years ago I constructed at Trerice China Clay works a *Circular* Head, the stream from which flowed over the whole of its circumference instead of over the diameter, as is the case in the ordinary patterns. This was an improvement, but as it was only about 8 ft. in diameter its capacity was too small. Some twelve years or so ago at Rosemellon I constructed another elutriating pit. This was about 14 ft. in diameter, and was much more effective ; in fact, it saved its cost in a few months in labour alone, without taking into account the saving of clay which was effected by not having to clean out the mica drags so often. Since then at various clay works they have been adopted with success and satisfaction, as they remove from the stream at the entrance to the mica drags the bulk of the coarse material. They take scarcely any time to clean, and if properly used do not waste clay. I have heard of one being constructed about 20 ft. in diameter, but I should personally hesitate to recommend one so large. I know also of one being constructed now about 10 ft. in diameter. This I consider too small. As a matter of experience and the result of careful observation and calculation I found that about 14 ft. is the most desirable size.

The drawings are sufficiently detailed not to need much explanation, and are easily adapted to any size by taking the inside diameter as a scale to work by.

If one elutriating pit is not sufficient others can be added either " in series," *i.e.*, one after the other, or " in parallel," *i.e.*, side by side. Which method would be better has to be ascertained by testing the clay stream.

I have found a good arrangement is to have three pits ; let the whole stream enter the first and divide the stream as it flows between the remaining two, but obviously a clay works using a stream of, say, 600 gallons per minute requires different arrangements from others which may be using, say, 300 or 1,000 gallons per minute. If the velocity in the pit is too high the coarse material will not settle ; if too low finer particles will settle in the pit than should do so.

Generally speaking, it will be found that the amount of kaolin which settles in these pits is absolutely negligible.



Plan for a China Clay Works

WE recently came across a curious French patent, taken out some years ago for the plan of a works, comprising the following points :—

The clay in the pit is conveyed by means of a winch to the mixer, into which it is then shovelled. The slip runs from the mixer into gutters, where the coarse sand deposits, and then flows slower and slower, until all the mica and silica have deposited, into three large pits in which the clay settles and concentrates before being pumped into the press filters. The perfectly clear water from the clay is driven by a centrifugal pump into the mixer, this operation being continually repeated.

The clay cakes from the filter are put on to shelved trucks and run into a tunnel under which there is an oven on the side where the loaded trucks pass out. Thus the floor of the tunnel is heated, whilst a fan drives a strong current of hot air against the moving trucks which pass out of the tunnel with the dry clay for storage.

Studies on China Clays

(Translated from the Bulletin de la Société Chimique de France.)

SILICATES of aluminium, both anhydrous and hydrated, are very abundant in nature and utilisable for many purposes in industry, especially in the form of clay for keramic products.

There is only one anhydrous silicate, SiO^2, Al^2O^3, in three different crystalline forms, viz., andalusite, disthene or cyanite; sillimanite.

The hydrated silicates are three in number:—

Allophane	.. ..	Al_2O_3, SiO_2, $6H_2O$
Kaolinite	.. ..	$2SiO_2$, Al_2O_3, $2H_2O$
Pyrophyllite	.. ..	$4SiO_2$, Al_2O_3, H^2O

The last may be regarded as complex acids (silico aluminic acids), pyrophyllite corresponding to leucite, $4SiO_2$, Al_2O_3, K_2O, and kaolinite to guarinite $2SiO_2$, Al_2O_3, $2CaO$. The comparison is less clear with allophane, in which it is difficult to distinguish the water of hydration from that of constitution owing to the relatively low temperature at which all the water disappears.

The most common of the hydrated silicates in nature is kaolinite, which exists under three different aspects belonging to individual deposits, viz., kaolin, clay, halloysite. The first two mixed with water give plastic pastes.

In the study of kaolins and clays, the centesimal composition is not the only question of interest. The immediate composition must also be specified, the mineralogical composition. Employment of mechanical methods of levigation, study of the action of heat, will also give useful information for a knowledge of clays and their properties.

In fact, it was recently pointed out by Messrs. Bertrand and Lanquini (*Comptes Rendus*, T. 169, p. 1171) that the chemical composition is not absolutely sufficient to give a true idea of the keramic properties, which also depend upon various factors relating to the physical condition of the clay, and brought to light by petrographic examination.

In spite of the many works already published and appearing every day in all countries, dealing with China Clay and clays, it will be useful to make a general study of these natural products, so varied and widely different, usually employed in the keramic arts. There will never be too many experimental records to throw a little more light upon what is yet obscure in the history of argillaceous earths.

Nine varieties of kaolins and clays were comparatively examined. [*Note.*—No precise measure for plasticity is yet known. The quantity of water required for a *normal paste* is given, estimating this water in proportion to the total humid mass. If we endeavour to classify the clays examined by the degree of plasticity practically noted by the same operator, and such classification is naturally not absolute, we obtain the following order (paste of normal consistency): 1. Westerwald; 2. Ball Clay; Marsaguet; St. Austell; Zettlitz. 3. Les Eyzies. 4. Poisvilliers. The halloysites are outside classification. Some clays are less plastic and drier, although more adhesive when making the paste. This is the case with the clays of Poisvilliers and Les Eyzies compared with that of Westerwald.] A Ball Clay (England) China Clay of St. Austell, West Carclaze clay No. 8 (sent by M. Sailly, January 1921). Greyish white mass, soapy to touch, friable and very plastic (31·2 per cent. water), adheres well to the tongue (3). (The property of a clay of adhering more or less to the tongue is indicated by the figures (1), (2), (3), (4), the highest figure representing the most adhesive). Remains white without cracks in desiccation, burns to a cream white (1,100° C.).

B. *St. Austell.* China Clay (sent by M. Marc, Larchevêque, 1920). In powder, very pure white; very oily and unctuous to touch; very plastic (26·3 per cent. water). Remains white and does not crack in desiccation; burns white (1,100° C.).

C. *Zettitz* (Germany). This kaolin had been a long time in the laboratory (given in 1906 by Seger). Very pure white powder, very oily and unctuous to touch (more so than Marsaguet); very plastic (33·3 per cent. water); adheres well to the tongue (3). Remains white and does not crack in desiccation; burns a very pure white (1,100° C.).

D. *Westerwald* (Germany). Capitain clay of Vallendar on the RHEE (sent by M. Sailly, January 1921). A grey white mass (the powder turns yellowish). Soapy to touch, very friable and very plastic (21 per cent. water); adheres well to the tongue (3). Yellowish grey, breaks into pieces in desiccation; burns to a yellowish grey with incipient crumbling (1,100° C.).

E. *Marsaguet* (Haute Vienne, France). Argillous kaolin AMP, Sevres selection (Vandermarcq quarries, January 1921). Very pure white in colour, soapy to touch, very friable and very plastic (30·9 per cent. water); adheres to the tongue (3). Remains white and cracks in desiccation; burns to a very pure white (1,100° C.).

F. *Poisvilliers* (Eure et Loire). Pipe clay (supplied by Poulenc in 1910). White powder, oily and soapy to touch; very plastic (20·2 per cent. water). Remains white without cracks in desiccation; burns white (1,100° C.).

G. *Les Eyzies* (Dordogne). Clay supplied by Mr. Sailly, (Bourgain No. 2, January 1921). More or less yellowish white, soapy, very friable and very plastic (28 per cent. water); adheres well to tongue (3). Remains white without cracks in desiccation (1,100° C.).

H. *Les Eyzies* (Dordogne). Halloysite (Vendemarcq quarries, January 1921). Very pure white mass, very clean fracture of conchoidal form; soapy to touch; adheres strongly to tongue (4); immersed in water crumbles very quickly, the thin edges becoming transparent. Mixed with water the paste has a granular aspect (35 per cent. water) without great consistency, sticks to the hands and falls to pieces like bread crumb. Turns yellow in the air, does not crack in desiccation; granular aspect; without body; burns white without consistency (1,100° C.).

I. *Coussac-Bouneval* (Haute Vienne). Halloysite (Vendermarcq quarries, January 1921). Dull white mass, no peculiarity in fracture; granular aspect; adheres slightly to tongue (1); immersed in water remains unchanged; excepting the mixing of the paste, this halloysite seems quite different to the preceding. Remains white without cracks in desiccation; granular aspect; without body; burns white (1,100° C.); better consistency than the preceding.

The kaolins usually employed in the porcelain industry are quite different in composition, and sometimes very unlike kaolinite.

The percentages of alkalies are very variable and often there are considerable quantities of lime. The water of constitution is also very variable.

These variations of composition are certainly due to the primitive rock which produced the kaolin, as was long ago demonstrated by Bischof and Seger, by employment of chemical reagents.

In fact, the different properties of a number of clays are profited by in practical work, which at the present time is more scientific than formerly. The manufacturer enters boldly into the path of progress and the French Syndicate for manufacture of keramic products has instituted a technical committee for scientific study of the kilns employed for clay products and a research laboratory has been founded for the benefit of members.

All those who yet doubt about the necessity of joint work by scientists and manufacturers to assume technical advance should read the address delivered by Sir Edward Thorpe at the annual meeting of the British Association for the Advancement of Sciences, Edinburgh 1921. They will there find sound instructions.

China Clay Inventor's Plight

AT a recent meeting of the St. Austell Board of Guardians they had before them a man who was described as an inventor of a new process for drying China Clay, who sought out-relief for himself and his family, now living in the St. Stephen's district, until such time as he could get his process patented. It was stated that some local people were interesting themselves in the man's invention and were prepared to acquire his interest should it prove successful. The man said he did not come before them as a cadger, but would repay whatever was advanced to him in relief. He had been in the district about seven months, came from up-country, and had been a potter. He had a promise of work in one of the China Clay works as soon as a job could be found for him. The Board decided to continue relief up to a certain limit.

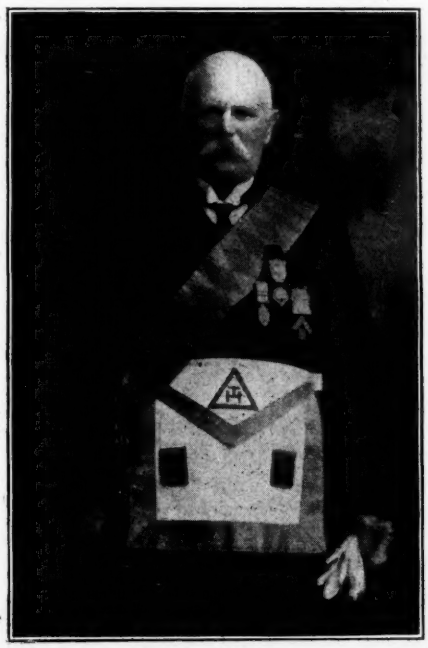
China Clay Notes and News

Accident in Clay Works

The China Clay industry has been rather unfortunate in another fatal accident, which occurred at the Blackpool China Clay works of Messrs. Parkyn and Peters. On February 18 an employee named Fred Bray was engaged in the removal of overburthen, and was assisted in the work by a young man called Hambly. They were on night-shift and had not commenced operations long before the accident happened. Just as they were emerging from a carefully-timbered level with a ladened tram-wagon something struck the outside timber sett, with the result that about a ton of debris fell upon both. The level became blocked and both were knocked down and rendered unconscious. When Hambly recovered he shouted for help, but Bray had expired before he was extricated. An enquiry was held by Mr. E. L. Carlyon, Coroner for the district, Mr. R. King, the Local Inspector of Mines, being also present.

Captain Ernest Hooper stated that he heard the signal of an accident at 7.10 p.m. and hurried at once to the spot, and found the deceased buried under about a ton of overburden. Some of the men were getting deceased out. Hundreds of loads had been trammed through the level since October. In his opinion something must have struck the outside post, but there was no indication on the timber of a blow. In reply to the Inspector of Mines, one of the witnesses said the wagon was not fully loaded. There were lights at the works, but these were not required, as it was good moonlight.

The Coroner said it seemed that the timbering had been struck by something, either the wagon or a stone projection. It is not likely that they will ever find out exactly what occurred, but deceased had no doubt been suffocated by being buried under the fall of debris, and a verdict to that effect was returned, and an expression of sympathy with the relatives was also tendered by the Coroner.



CAPT. C. G. PERRY

Freemasonry

The China Clay industry is well represented in the local Freemasonry craft. Quite recently Mr. E. J. Hancock, managing director of the West Carclaze China Clay Co., Ltd., and a director of the Associated China Clays, Ltd., was installed Worshipful Master of the St. Austell Peace and Harmony Lodge, No. 496, which has proved quite a popular appointment. Since our last issue Captain Caleb G. Perry, at the annual convocation of the Mount Edgcumbe Chapter of the Royal Archmasons, No. 496, St. Austell, was installed Z by Ex-Comp. C. F. Collins. Amongst the subordinate appointments were Mr. H. E. Riley, a prominent engineer in the industry, and Mr. S. Benson, secretary to the Associated China Clays, Ltd. Captain Perry, who is a native of St. Austell, has been associated with the China Clay industry for over 40 years, formerly under the West of England China Clay and Stone Co., and latterly with the English China Clays, Ltd., since its absorption. For several years Captain Perry was assistant superintendent of the Carran-Carrow China Clay Works, and was eventually appointed works manager at the Hemerdon Clay Works in Devonshire. It was whilst in Devonshire that Captain Perry evinced such considerable interest in the Lodge at Plympton, with which he became Past Z of the Sincerity Chapter, No. 189, Devon, upon the retirement of Captain Paul Peters, a few years ago. Captain Perry returned to St. Austell as superintendent of the Carran-Carrow Works.

The long experience which Captain Perry has had in the actual process of China Clay production and the confidence which the firm has reposed in him for over 40 years, serves to indicate the class of men who are actually engaged in maintaining the best examples of products from the mines they supervise.

Our readers, particularly those associated with the craft, will proffer their congratulations to Captain Perry upon his elevation and the firm, the English China Clays, who are considered fortunate to have such in their service.

The Germano-Bohemian Kaolin Cartel

About the middle of January, 1924, the Czecho Kaolin Works seceded from the cartel established four years ago by German and Bohemian firms. It appears that the Germans disregarded the stipulations concerning prices and terms for sales.

German Porcelain Works

After a particularly slack period, from August to October, 1923, there was a slight revival in demand, and the small factories, nearly all of which had shut down, are again fully occupied. Demand was particularly keen about Christmas. There are plenty of orders for ordinary porcelain, whilst, on the other hand, there is much to be desired in the case of artistic porcelain.

Superiority of English China Clay

Dependent as the rest of the world has been upon the unlimited supplies of English China Clays from Cornwall, it is, we suppose, says the *Canadian Pulp and Paper Magazine*, only natural that other countries should seek to find, within their own borders, clays approximating in quality and chemical constitutents to those they have been in the habit of importing. With rare exceptions foreign exploiters have failed to find anywhere else in the world any kaolins to equal the quality of the best English China Clays, but they have succeeded in developing some clay deposits that are at least equal to the common China Clays of the West of England.

It is a matter of common knowledge that for some time past American users of this invaluable product have lately combined with a view of discovering other sources of supply Up to the present it is a fact that only a relatively few deposits of good China Clay of any commercial value have been found in the U.S.A.

Varcoes China Clays, Ltd.

Mr. R. G. Varcoe, director of this company, Manchester, reports that the demand for China Clay in the North is fairly brisk, prices ranging from 57s. 6d. per ton to 110s. per ton delivered, via station, bags returnable.

Mr. Varcoe reports more uses for China Clay being found as time goes on, and there is no doubt that it is one of the cheapest white fillers on the market, and that the demand for this commodity will be, and is, annually increasing as new uses are found.

Messrs. Varcoes China Clays, Ltd., are sole agents for the Cornish Kaolin, Ltd., and the Tehidy, Ltd., China Clays which have an excellent reputation, and are being largely distributed to the various customers.

Mr. Varcoe is also a director of the Cornwall Porcelain Clays, Ltd., which company incidentally own and work a felspar quarry in Cornwall. This is quite unique, as felspar is rarely found in England at the present time. The Cornwall Porcelain Clays, Ltd., also own Chapel and Trenouth Grinding Mills, where they grind felspar, china stone and silica. These mills being worked by water power enable them, of course, to produce cheaply, consequently business at these mills is always fairly brisk.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Fowey Shipping—February, 1924

Arrived.	Name.	Sailed	Destination.
Feb. 1, S.S.	*Ferndene*	Feb. 9,	Ridham
Feb. 1, M.V.	*Laanemaa*	Feb. 7,	Brussels
Feb. 1, S.S.	*Blush Rose*	Feb. 7,	Preston
Feb. 1, S.S.	*Sado*	Feb. 11,	Bilbao & Passages
Feb. 1, S.S.	*Hayle*	Feb. 8,	Preston
Feb. 1,	*Margarethe*	Feb. 18,	Leith
Feb. 2,	*Hanna Jensen*	Feb. 18,	Leith
Feb. 2, S.S.	*Camm*	Feb. 7,	Gravesend
Feb. 5, S.S.	*Beeston*	Feb. 9,	Barrow
Feb. 5, S.S.	*Dolphin*	Feb. 11,	Antwerp
Feb. 5, S.S.	*Lancashire*	Feb. 12,	Antwerp
Feb. 5, S.S.	*Lowland-Firth*	Feb. 12,	Gravesend
Feb. 6,	*Gerda*	Feb. 29,	Kirkcaldy
Feb. 6,	*Elsa*	Feb. 19,	Runcorn
Feb. 6, S.S.	*Ciscar*	Feb. 12,	Genoa
Feb. 7, S.S.	*Alekto*	Feb. 13,	Bo'ness
Feb. 7, S.S.	*Allerton*	Feb. 13,	Birkenhead
Feb. 7, S.S.	*Jolly Frank*	Feb. 12,	Rochester
Feb. 8, S.S.	*Jolly Guy*	Feb. 13,	Ridham
Feb. 8,	*Alice Williams*	Feb. 27,	Runcorn
Feb. 8, S.S.	*Grosvenor*	Feb. 12,	Preston
Feb. 10, S.S.	*Sturdee Rose*	Feb. 13,	Preston
Feb. 11, M.V.	*Lydia Cardell*	Feb. 28,	Antwerp
Feb. 11,	*J. H. Barrow*	Feb. 29,	Irvin
Feb. 11, S.S.	*Moss Rose*	Feb. 14,	Weston Point
Feb. 14, S.S.	*Broadgreen*	Feb. 16,	Passages
Feb. 14, S.S.	*Spaarnestroom*	Feb. 16,	Amsterdam
Feb. 14, S.S.	*Shoreham*	Feb. 16,	Preston
Feb. 14,	*Dispatch*	Mar. 4,	Runcorn
Feb. 14, S.S.	*Mersey*	Feb. 16,	Garston
Feb. 14, S.S.	*Brier Rose*	Feb. 16,	Preston
Feb. 15, S.S.	*Shellie*	Feb. 18,	Par
Feb. 15,	*James Postlethwaite*	Feb. 18,	Mevagissey
Feb. 15, S.S.	*Condor*	Feb. 19,	Par
Feb. 15, M.V.	*Isabel*	Feb. 20,	Pentewan
Feb. 17,	*Alida*	Mar. 6,	Leith
Feb. 17,	*Snowflake*	Feb. 18,	Par
Feb. 17, S.S.	*Siltonhall*	Mar. 5,	Portland Me
Feb. 17, S.S.	*Sutton*	Feb. 27,	Aberdeen
Feb. 17, S.S.	*Ualan*	Mar. 4,	Ternuezen
Feb. 18, S.S.	*Thyra*	Feb. 29,	Genoa
Feb. 18, S.S.	*Industria*	Feb. 28,	Passages
Feb. 18,	*Amanda*	Feb. 19,	Charlestown
Feb. 18, S.S.	*Saxilby*	Mar. 5,	Portland Me
Feb. 19, S.S.	*India Maru*		*
Feb. 19, S.S.	*Moneyspinner*	Mar. 1,	Antwerp
Feb. 21, S.S.	*Primrose*	Mar. 2,	Hull
Feb. 21, S.S.	*Hayle*	Feb. 29,	Preston
Feb. 21, S.S.	*Shellie*	Feb. 26,	Fleetwood
Feb. 22, S.S.	*Karachi Maru*		*
Feb. 22, S.S.	*Condor*	Feb. 28,	Antwerp
Feb. 23,	*Helena Anna*	Mar. 8,	Runcorn
Feb. 25,	*Thames*	Mar. 7,	Plymouth
Feb. 26,	*Rose*	Mar. 5,	Cardiff
Feb. 27,	*Amanda*	Mar. 3,	Runcorn
Feb. 28, S.S.	*Brixham*	Mar 4,	Rouen
Feb. 28, S.S.	*Edern*	Mar. 5,	Ridham
Feb. 28, S.S.	*Urpeth*	Mar. 7,	Brussels

Par Harbour Shipping—February, 1924

Arrivals

Date	Vessel.	From
Feb. 2, S.S.	*Treleigh*	Penzance
Feb. 2, S.V.	*Lord Devon*	Plymouth
Feb. 2, S.V.	*Cambria*	Torquay
Feb. 3, S.S.	*Christiana*	Barry
Feb. 5, S.V.	*Regina*	Plymouth
Feb. 11, S.V.	*Rhoda Mary*	Falmouth
Feb. 16, S.V.	*Venturer*	Exmouth
Feb. 18, S.S.	*Shellie*	Fowey
Feb. 18, S.V.	*Snowflake*	Runcorn
Feb. 19, S.S.	*Condor*	Fowey
Feb. 21, M.V.	*Hetty*	West Bank
Feb. 21, S.V.	*Regina*	Penryn
Feb. 24, S.V.	*Irish Minstrel*	Cardiff
Feb. 27, S.S.	*Multistone*	Kingsbridge
Feb. 28, S.V.	*Rosina*	Gweek
Feb. 28, S.V.	*Emily Warbrick*	Falmouth
Feb. 29, S.V.	*Pet*	Falmouth

Sailings

Date.	Vessel	Destination.
Feb. 2, S.S.	*Torpoint*	Penarth
Feb. 5, S.S.	*Trepeigh*	Penarth
Feb. 6, S.S.	*Inchbrayock*	Gravesend
Feb. 10, S.S.	*Christiana*	Fleetwood
Feb. 11, S.V.	*Naiad*	Newcastle
Feb. 15, M.V.	*Regina*	Plymouth
Feb. 20, S.V.	*Lord Devon*	Runcorn
Feb. 21, S.S.	*Shellie*	Fowey
Feb. 22, S.V.	*Cambria*	Queenborough
Feb. 22, S.S.	*Condor*	Fowey
Feb. 22, S.V.	*Rhoda Mary*	Runcorn
Feb. 25, S.V.	*Two Sisters*	Antwerp

Charlestown Shipping

Arrivals for February, 1924

Date.	Vessel.	From
Feb. 3	*Saltom*	Cardiff
Feb. 9	*Murtfors*	Totnes
Feb. 16	*Raymond*	Fowey
Feb. 18	*Hibernia*	Plymouth
Feb. 18	*Jos Postlethwaite*	Ardrossan
Feb. 19	*Amanda*	Preston
Feb. 21	*Jolly Laura*	Teignmouth
Feb. 21	*Adelaide*	Newport (Mon.)
Feb. 23	*Waterwitch*	Falmouth
Feb. 23	*Heatherlea*	Portsmouth
Feb. 24	*Louistic*	Cardiff
Feb. 25	*Jantin Finnegior*	Rafso
Feb. 27	*Jolly Marie*	Poole

Sailings For February, 1924

Date.	Vessel.	Destination.
Feb. 2	*Linton*	Rouen
Feb. 2	*St. Austell*	S. Malo
Feb. 5	*Madeliene*	Nantes
Feb. 6	*Saltom*	Runcorn
Feb. 9	*Murtfors*	Brussels
Feb. 20	*Raymond*	Rochester
Feb. 21	*Hibernia*	London
Feb. 21	*Jolly Laura*	London
Feb. 26	*Waterwitch*	Runcorn
Feb. 26	*Lady Daphne*	Rochester
Feb. 25	*Heatherlea*	London
Feb. 27	*Amanda*	Preston
Feb. 27	*Jolly Marie*	London

Par Harbour Tide Table, March, 1924

(*Greenwich Mean Time throughout.*)

Day of Week	Day of Month.	Morning.	Afternoon.	Height.
Saturday	1	0.51	1.37	10. 1
SUNDAY	2	2.19	2.58	10. 8
Monday	3	3.34	4. 4	11. 4
Tuesday	4	4.31	4.55	12. 2
Wednesday	5	5.18	5.40	12. 9
Thursday	6	6. 0	6.18	13. 3
Saturday	8	7. 9	7.24	13. 2
Friday	7	6.36	6.53	13. 4
SUNDAY	9	7.39	7.54	12. 9
Monday	10	8.11	8.26	12. 2
Tuesday	11	8.40	8.54	11. 6
Wednesday	12	9.11	9.30	10. 9
Thursday	13	9.50	10.13	9.11
Friday	14	10.40	11.14	9. 4
Saturday	15	11.52	—	8.10
SUNDAY	16	0.36	1.20*	9. 0
Monday	17	2. 2	2.39	9. 7
Tuesday	18	3.11	3.39	10. 7
Wednesday	19	4. 3	4.27	11. 9
Thursday	20	4.50	5.12	12. 9
Friday	21	2.31	5.51	13. 7
Saturday	22	6.11	6.32	14. 0
SUNDAY	23	6.51	7. 9	14. 2
Monday	24	7.18	7.47	14. 0
Tuesday	25	8. 8	8.30	13. 5
Wednesday	26	8.52	9.13	12. 6
Thursday	27	9.39	10. 5	11. 6
Friday	28	10.36	11.11	10. 5
Saturday	29	11.54	—	9. 8
SUNDAY	30	0.39	1.24	9. 9
Monday	31	2. 7	2.44	10. 3

H. L. VICARY, Harbourmaster.

February China Clay Deliveries

THE dockers' strike seriously affected the shipments of China Clay during February, with the result that the total deliveries are down by nearly 10,000 tons compared with January, January having been down by nearly 9,000 tons from the total of December through the railway strike. Thus on the two months there has been a decrease in deliveries of nearly 19,000 tons.

In consequence of the dockers' strike in February, it will be noticed that the deliveries direct by rail were considerably increased, the total of nearly 7,000 tons being unusual. In addition to the shipments given below 1,116 tons of ball clay were also shipped from Fowey.

Details : Port.	Tonnage
Fowey (including china stone, 1,581 tons)	38,125
Charlestown	3,445
Par	2,885
Newham	242
Plymouth	157
By rail (including china stone, 1,523 tons)	6,886
Total	51,740

China Clay Exports

RETURN showing the exports of China Clay, including Cornish or China Stone, the produce or manufacture of the United Kingdom, from the United Kingdom to each country of destination registered during the month ended 29th February, 1924.

COUNTRY OF DESTINATION	QUANTITY Tons.	VALUE. £
Sweden	319	468
Denmark	188	700
Germany	198	560
Netherlands	3,367	9,386
Belgium	2,630	5,527
France	1,892	4,146
Spain	2,299	6,409
Italy	648	1,944
Roumania	1	4
China	—	10
United States of America, Atlantic	18,492	44,608
United States of America, Pacific	90	749
Peru	3	14
Brazil	3	18
Argentine Republic	15	97
Bombay via Karachi	4	28
Bombay via other ports	2,351	9,322
Madras	73	271
Bengal	26	104
Victoria	24	125
New South Wales	4	14
Irish Free State	10	23
	* 32,637	84,527

* These figures are correct although differing from monthly published account.

Pentewan Docks

IN a recent issue of the CHINA CLAY TRADE REVIEW we called attention to the almost derelict position of the Pentewan Docks, which have been practically idle since the rails and rolling stock of the railway connecting the town of St. Austell were taken up for war purposes. We then directed some consideration of the opportunities which were rapidly slipping away of securing some of the former China Clay traffic because so many of the works that formerly used these docks for the exportation of China Clay were being linked up to the various branches of the Great Western Railway and are now adding to the extensive shipping at Fowey. In the palmier days of Pentewan Docks approximately 200 of the smaller sailing craft would visit the port in the course of a year and take with them in the aggregate from 20,000 to 30,000 tons of clay to the Continent and home markets. The clay was loaded at West Bridge, St. Austell, where there are cellars and a wharf for loading casks, as well as a commodious yard with several lines of rails, still waiting for the resuscitation of both docks and railway. The distance from St. Austell to Pentewan is four miles through the lovely Pentewan Valley, and it affords one of the best propositions for a railway imaginable. A small engine could take down from 20 to 30 truck loads at a time, because there is no gradient to negotiate. We understand that negotiations are now proceeding for the entire transfer of the docks at Pentewan and also the railway, and it is intended, if successful, to develop this property to its fullest capacity. A representative of the CHINA CLAY TRADE REVIEW called upon the principal Director of the Estate for the confirmation of the current story of this important project, and was courteously informed that the matter was undergoing very serious consideration, and the CHINA CLAY TRADE REVIEW should be made acquainted with the result as early as possible. Villages at Pentewan are naturally animated with the prospects of a busy port once more. It would indeed be a very striking contrast to see these docks full of loading sailing craft again, shipping clay to our home ports and the Continent, and the congestion of China Clay wagons at West Bridge at the St. Austell end, which was a frequent sight before the war. Pentewan is rapidly becoming popular as a healthy holiday resort, but the whole community will unite in the expression of a very earnest hope that the negotiations will result successfully and very shortly the railway and docks will be humming with activity.

China Clay in Czecho-Slovakia

CHINA Clay is one of the chief products amongst raw materials, representing 400,000 metric tons yearly.

Zettlik kaolin has a world-wide reputation, and is found in the vicinity of Karlovy-Vary, Carlsbad. It is almost pure kaolinite with an extremely high degree of plasticity. It contains 99·3 to 99·9 per cent. of kaolinite, and the chemical composition is :—

SiO^2	45·92
Al^2O^3	38·17
Fe^2O^3	0·50
TiO^2	0·05
CaO	0·15
MgO	0·11
KNaO	1·10
H^2O	13·95

The Czecho-Slovakian China Clay is partly utilised in the country for porcelain, faïence and paper. In 1922, 218,472 metric tons were exported, 7,722 of which went to France There are 70 large porcelain works in Czecho-Slovakia and many small. Tunnel kilns, both biscuit and enamel, of the Faugeron and Furbringer types are utilised. The annual production is about 50,000 metric tons. The insulators support 200,000 volts.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ELLGREAVE POTTERY CO., LTD., Burslem. Registered February 1, £7,000 debentures; general charge. *——. August 14, 1922.

JOHNSTON BRICK AND TILE WORKS, LTD., Cardiff. Registered February 16, £5 500 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £2 000; general charge. *Nil. December 31, 1922.

Satisfaction

PORTALS, LTD., Whitchurch (Hants), paper manufacturers. Satisfaction registered February 5, £30 000, part of amount registered May 25, 1920.

London Gazette

Company Winding Up Voluntarily

OAK HILL BRICK AND TILE CO., LTD. Fred Moss, Market Place, Ashton-under-Lyne, accountant, appointed liquidator.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

China Clay or Kaolin

THE origin and use of China Clay or Kaolin is, of course, well understood by all in the trade, but there are a large number of readers of this REVIEW who have a very vague idea of what China Clay really is, and even some consumers of this valuable raw material seem to possess very little knowledge of its many uses. We therefore make no apologies for giving in our Editorial a short account of the production and use of China Clay, believing that it will be of interest to many of our readers.

China Clay or Kaolin is so called because of its origin. In China it has been used to historic knowledge for over 1,000 years. The word Kaolin is of Chinese origin; it was the name given in China to the white prepared Clay originally from a hill called Kao-ling, meaning the white ridge. Many white clays in America are styled Kaolins which are, in fact, "Ball Clays"; but in Europe Kaolin is usually understood to mean the prepared commercial article; in other words, it is synonymous with China Clay. The China Clay industry of the West of England dates back only some 150 years, its discovery and early developments were due to the activities of William Cookworthy, a native of Kingsbridge, in Devonshire. The exports of China Clay and stone from Cornwall commenced soon after Cookworthy's discovery, for in 1759 we find small quantities of these materials being used in the Staffordshire potteries. China Clay is really decomposed felspar from granite rock.

Like so many products from the earth, it enters into the composition of commercial necessities and luxuries used daily by everyone. Few people realise the materials required for making the articles of daily use, and it would surprise most of them to learn that the paper they use and the daily journals they read contain considerable quantities of China Clay. The very general idea that China Clay is used in the making of chinaware and earthenware is perfectly correct, but probably very few realise that it enters into the making of a very large number of other articles, soaps, powders, washing blues, tooth pastes, boot polishes, ultramarine, etc. The composition of China Clay is largely alumina of silica.

In England, China Clay is found and worked only in Cornwall and Devon. Employment in the various branches covers nearly 10,000 manual workers and gives support to large districts and towns. These districts and towns owe their creation to the industry, and their existence depends upon its maintenance and prosperity. Although the discovery of China Clay in Cornwall dates back over 150 years it is only in comparatively recent years that the industry has become one of activity, and at the present time a normal year's output is about 1,000,000 tons.

China Clay is worked in the form of large open pits. Many pits are 200 or 300 ft. deep, and some are even more. They frequently have an open surface of anything from 10 to 30, or even 40 acres. The deposits may cover from 50 to 400 acres, and the appearance of an open pit is white, almost like chalk. The Clay when ready for commercial use, after treatment by washing with water, may be likened to flour in appearance. Methods of winning China Clay may still be looked upon as rather crude, although of late considerable advance has been made in this direction. Improved methods of clearing overburden are being studied, and attention has recently been given to hydraulics in the pits. Filter pressing for drying the China Clay is being found a successful method under certain conditions. Gas engines and electric appliances are taking the place of the old Cornish engines. Centrifugal pumps are now being used in many of the pits. These and many more improvements and innovations are yearly being followed by others. Since the commencement of this journal it has been our object to keep our readers informed on these matters and to give an account of each company's property and workings.

The great interest shown and the developments made by the railway company we have recorded.

Not only is this of local interest to producers in Cornwall, but to those all over the British Isles who are consumers of China Clay, notably, perhaps, the potters in Staffordshire.

As the export of China Clay is by far the largest trade, shipping and freights have always had our attention with useful data and records.

The possibilities of further uses for China Clay seem almost unlimited. Until the last few years little attention has been given to it by commercial chemists. The largest producing company includes in its organisation a laboratory where, among other research work, close attention has been given to methods for obtaining China Clay in colloidal form or as an impalpable powder. The research has been successful and patents taken, and we are informed that quite an extensive plant is now at work, capable of placing upon the market many thousands of tons of this Clay per annum. Other firms have also produced Colloidal Clay but possibly by rather different methods. Colloidal Clay has valuable medicinal properties and should, in addition claim close attention from commercial chemists.

The Associated China Clays, Ltd.

WITH the formation of the Associated China Clays, Ltd., some years ago a feeling of security was introduced into the trade, which up to that time had been lacking. Previous to that period the China Clay trade had been conducted on lines of "cutting" below your neighbour, with the inevitable result that many firms had the greatest difficulty in keeping going at all.

When an industry had to adopt such methods to obtain trade—bad, in the long run, both for producer and consumer—it was felt that by coming together to regulate prices, which should be fair both to the trade and their clients, a step in the right direction had been made.

The Associated China Clays, Ltd., was formed and supported by practically the whole trade, a few of the smaller firms standing out, as will always happen with every such organisation. The success of the Association was at once apparent, but, even so, there have been times, through various causes, when a "split" seemed not far away.

At the annual general meeting, held on March 19, the chairman, the Hon. H. D. McLaren, C.B.E., commenting upon the crisis in the Association of the industry in the spring of last year, said that when the bulk of the China Clay producers realised what the termination of their Association would involve, it was surprising, and none the less gratifying, to observe the strength of the support in favour of maintaining the safeguards, which had resulted so greatly to the benefit of the industry as a whole. The continuance of the organisation was therefore more than justified.

THE CHINA CLAY TRADE REVIEW has firmly supported the Association from the commencement, believing that it has been the salvation of the industry.

Unfortunately, since the annual meeting a further crisis has arisen, and on March 31 a special meeting of the Board was held at St. Austell at which it was decided to call a special general meeting for Monday, April 14, to decide as to the continuance or the cessation of the Association. We can only hope that wisdom will prevail once again and the deplorable results which are bound to occur with the break up of the Association may be averted.

It is believed that something like £500,000 would be lost to the district in the first year after the cessation of the Association. With a considerable increase in the competition of domestic clays in various countries, not in America alone, but on the Continent, especially those produced in the South of France, Czecho-Slovakia and India, it would seem the height of folly to, at this point, even think of terminating an Association which has done so much for the industry as a whole.

Mr. T. Medland Stocker, J.P., one of the managing directors of the Association, in seconding the report at the annual meeting spoke of the great value of the organisation to the trade when all producers remained loyal to it and adhered to its basic principle of equality. If this cannot be maintained, and the cessation of the Association becomes a fact, unless financial interests can come together, the results will be bad not only for the producers, the employers, and the royalty owners, but ultimately would react upon the consumers of China Clay.

Since writing the above Notes we are informed that the various points of disagreement amongst members were satisfactorily settled and that the Association will continue. It is to be hoped that those few producers not members will now, in their own interest, at once seek membership.

A flourishing source of supply is better than a disorganised one.

Some Properties of China Clay in Refining Petroleum

INDEPENDENTLY of the action on the colour of oils, clays possess many other interesting ones from the point of view of petroleum.

In refining lubricating oils, for example, there is great inconvenience due to the formation of persisting emulsions, produced during washing of the oils with water after treatment with more or less diluted caustic lyes. Such emulsions can be prevented by eliminating the products which produce them, by agitating the oil with small quantities of well desiccated clay.

This property can also be utilised in refining heavy or lamp oil produced at the end of distillation or by slow distillation, in large boilers, of the residues of crude petroleum previously cracked in black pots.

Under the action of heat petroleum oils undergo decompositions which have long been utilised in refining, to transform heavy oils into others with a less high boiling point and rich in light oils which, besides, are very odoriferous. This was the origin of the new industry, during the past ten years, for the production of gasolines styled "cracking," starting from lamp or heavy oils or even combustible residues.

Amongst these compounds some have the property of forming with sulphuric acid, sulpho-acids which give, with soda, soaps soluble in mineral oils and consequently impossible to separate by filtration or even long repose in tanks. These soaps produce an abundance of sulphuretted hydrogen and sulphurous acid, when the gasolines are redistilled and the lamp oils from cracking refined.

Independently of the attacks these salts may cause in motors, they are yet more noxious in lighting lamps with wicks. They produce those carbonous crusts on the end of the wick which prevent the rise of oil, thus quickly decreasing the luminous intensity.

To avoid all this there are two methods :—

1. Treat the oils and gasolines after refining with desiccated clay.

2. Operate this treatment immediately after the application of acid and separation of tar.

The second method is much more preferable not only because it avoids emulsions during refining but also because it gives much better refined products.

The following is an interesting example of the use of clay for lamp oils. At one time imported refined petroleum in France had a degree of inflammability at about the limit exacted by the Government, viz., 35° C. There were also oils sold in the markets, with premiums, styled "safety" or "de luxe," inflammable at temperatures of 45° to 50° C. As long as the oils were refined and distilled in France these "safety" oils were extracted from natural raw materials. When, however, this industry ceased to exist some more economic method had to be found. The idea then occurred to the French experimenter, M. Guiselin, of redistilling the imported Standard White petroleum to extract medium oils with high inflammability point and at the same time recover the light oils distilled at below about 175° C. for immediate use in motors. A first obstacle was that although these oils were well bleached after refining with acid and soda they burnt very badly in lamps, fouling the wicks in a few hours, which required frequent trimming. After investigations it was found that this was due to the mineral compounds in cracked oils concentrating rapidly on the ends of the wicks in form of carbonous crusts rich in sodium sulphate. This was remedied by a treatment with clay after washing with a very diluted soda solution and omitting acid refining.

Washing with soda was necessary to saturate the sulphurous acid produced in redistillation, the clay forming a useful supplement in purification, without introducing acidity or soluble substances.

Thus, thanks to this method, redistilled oils could rival the best "Water White" imported at great expense from the United States.

Simplification of Plant

As an interesting property of clay in refining the following may also be noted. The various operations of refining yet occasionally executed in France are in vast vertical cylindrical tanks with conical bases and constructed of steel plate. They are mounted on masonry pillars. Agitation is produced by a strong current of air blown in at the base of the tank.

The diluted acid and soda utilised make it necessary to line these tanks with very expensive lead, which, however, is soon worn out under the action of soda and some naphthenic acids. Consequently refineries in other countries employ two superposed tanks so that the oil can be treated with acid in one and soda in the other, to be finally washed with water. In this way the metal is not attacked. It is not, however, always possible to utilise this plant, and besides the ordinary operations it is sometimes necessary to work on a smaller scale in improvised tanks. In such case the attack of the metal can be prevented by the use of clay and all the work done in the same tank. For this it is merely necessary, after the treatment with acid and decanting the tar, to precipitate the last traces by agitation with some well desiccated clay which can be removed at the base through the openings a little before the deposit has acquired consistency.

Les Matières Grasses.
March 15, 1924.

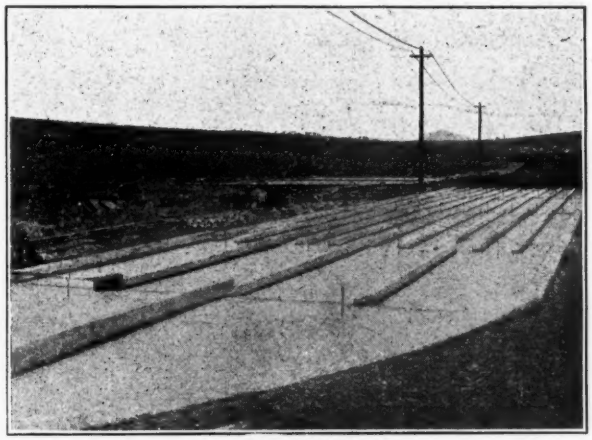
Among the Cornish China Clay Mines

An Interesting Visit to the Great Halviggan Works.

To realise the many important developments made in the China Clay industry within the past few years there is perhaps no better channel for the enlightenment of the consumers of China Clay than the features introduced in *The China Clay Trade Review*, viz., "Among the Cornish China Clay Mines," and certainly no series of reviews would be complete without the inclusion of the Great Halviggan China Clay Works near St. Austell. Like most of the best works Great Halviggan is located in a treeless tract of gorse-land, almost within a couple of miles of the China Clay town of St. Austell, the official hub of the industry. It was a source of interest to the writer to receive instructions from the Editor to visit this mine for the readers of the *China Clay Trade Review*. Through the kindness of the Local Manager, Mr. Hart Nicholls, the journey to Great Halviggan was achieved within a quarter of an hour by the powerful car placed at our disposal, and the climb to St. Mewan Beacon was accomplished with ease and celerity. From this rocky altitude at the works a most entrancing scene is unrolled to the visitor of the China Clay town of St. Austell, so serenely nestling among clusters of trees on the side of a verdant valley leading to the port of Pentewan. It was the writer's first visit to Great Halviggan, and the perfect operations carried out at this mine were most animating, even to one initiated in the trade. Captain Rabey, the firm's works supervisor, gave us a cordial welcome and we proceeded at

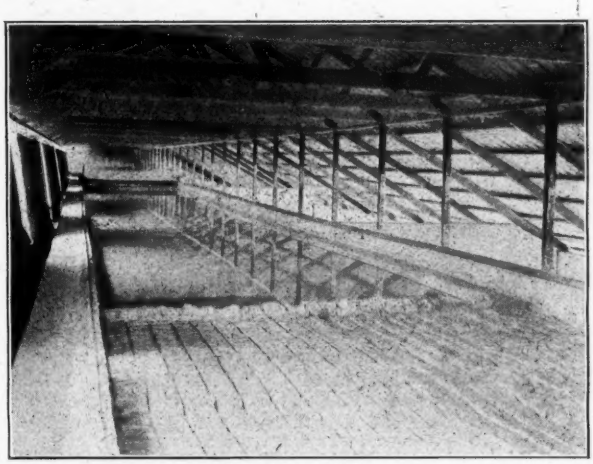
GREAT HALVIGGAN PIT.

once to the pit, which formed a huge white gulf of nearly 30 acres and about 120 feet deep. The accompanying illustrations, taken exclusively for this article, will interest the consumers of the renowned L.H. Clay, so extensively used for bleaching and high-class paper manufacture. The overburthen at the Great Halviggan is rather shallow compared with many mines and is systematically removed a considerable width around the entire pit, so that the operations in the early stages of production are free from pollution. Hydraulic hoses have been introduced with highly satisfactory results and the sides of the white stratum are wonderfully scarified by the enormous force of good spring water which soon becomes impregnated with clay. The pressure for the hoses is obtained from an electrical-rotary pump capable of delivering a stream of water at the rate of 750 gallons per minute. This method is a remarkable labour-saving device, and the engine runs the whole day with comparatively little or no attention. A single hose is calculated to do the work of at least four breakers and a couple of washers. Another comparatively recent feature indicative of the progressive spirit of the firm has been the installation of a modern twin-cylinder 150 b.h.p. gas engine and open hearth suction gas plant. These drive an 85 k.w. generator which produces the power for the twin slurry pump to lift the liquid clay to the surface at the rate of 500 gallons per minute. After passing through a series of new refining micas the clay water collects in two new concentration tanks, when



THE MICAS.

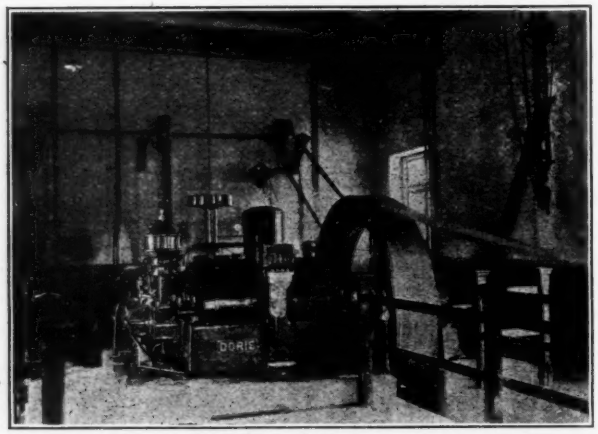
another small rotary pump forces it a further 40 feet to the top of the hill; thence by its own gravitation it is conveyed to the new dry, just completed at Burngullow, a station on the main line of the Great Western Railway, two miles west of St. Austell. The power station is a well-constructed building, 60 feet by 25 feet, and in addition to the main engine there is a small subsidiary power plant in case of emergency. It is interesting to observe the great care exhibited by the engineers generally for the smooth and satisfactory running of their engines. Although the Great Halviggan Co. have not scrapped the whole of their steam plant, the advantages accruing from a centralised power station are gradually usurping steam. The old pumping engine of 100 h.p., which was installed at the works many years ago, is now being used exclusively for hauling purposes, but attached to this engine is quite a modern winding plant of four of the latest winding drums with mechanical indicators and electrical signalling. The haulage of the sand and waste from the pits to the surface has become much improved; heavier skips are now drawn to a considerable height to permit them being automatically tipped, a process which eliminates considerable



INTERIOR OF DRY.

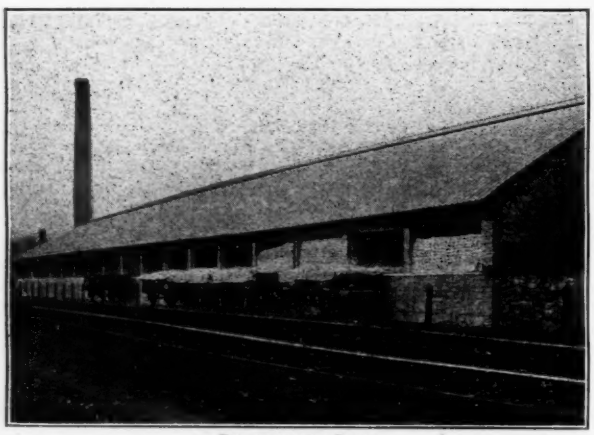
manual labour as well as effecting an economy in ground area. The mica drags and channels are devised upon the very latest principle to ensure an indisputable good brand of clay, for which

the Great Halviggan has a very high reputation. The old kilns, which are situate near the works and some distance down the Gover Valley, will not be entirely discarded, but will be used to subsidise the output of the new dry and to dry lower graded clays. As we have already indicated, the new



POWER HOUSE.

kiln is one of the very latest in the industry, and its erection was achieved within six months, which must have established quite an interesting record. With the firm's characteristic prudence an ideal freehold site was acquired at Methrose, near Burngullow, alongside the main line of the Great Western Railway. The kiln, as our illustration depicts, is a very imposing building and is 275 feet in length and 18 feet 9 inches wide, and is constructed of granite and reinforced concrete and is covered with the famous " Everite " roofing, a combination of cement and asbestos which cannot be excelled for protection and durability. There are seven large settling tanks capable of holding 5,000 tons of wet clay on one side of



DISPATCH BY RAIL.

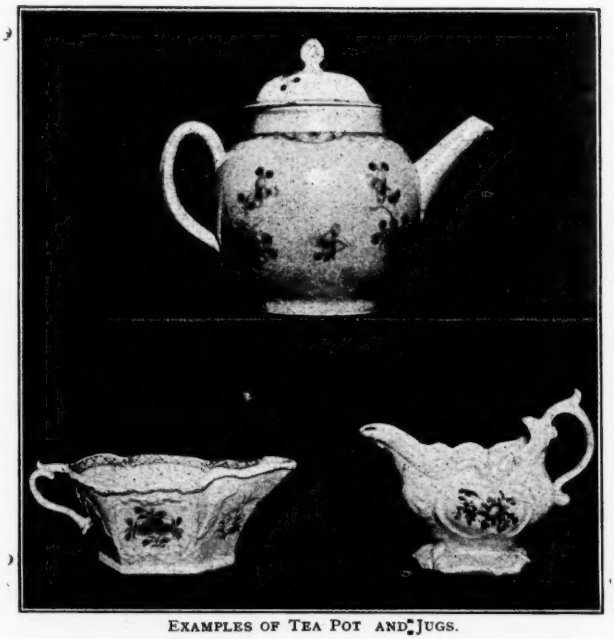
the dry, whereas on the other facing the railway there is a commodious linhay with a twelve feet drop from the pan and a storage capacity of 4,000 tons. Its completion provides the minutest facility to the employees in handling this highly finished product, and, what is of more import to the consumer, the strictest attention has been given to each stage of its process to ensure a cleanliness that should satisfy the most exacting client. The new kiln has a drying capacity of 16,000 tons per annum and four men are regularly employed in the drying operation, whilst a fifth man is especially detailed to attend to the furnace, so that production may be complete and continuous. Loading the clay into the railway trucks is essentially an arduous task, but the firm's own private railway siding contributes very considerably to reduce manual exertion to a minimum and facilitate despatch. There is a double line of rails which enables the firm to despatch large orders without delay, and ample provision is secured for future expansion when the demand arises. By an ingenious arrangement the waste water from the tanks is even conserved for the washing out of the railway trucks before loading, thus avoiding the risk of soiling the sample in transit. The name of the firm, Messrs. John Haworth and Co., Ltd., Whitefield, Manchester, appear in bold letters along the side facing the railway, so that all visitors to the West—even the Cornish Riviera—cannot fail to see some of the operations of this enterprising firm. The whole of the share interest of the Great Halviggan China Clay Co. was purchased in 1919 by Mr. James Haworth, who is chairman, and the board of directors is composed of Mr. J. S. Hardman, a brother-in-law, and Mr. G. H. Hardman, nephew. The Great Halviggan Mine has a unique and strategic position by the very short distance that divides the works from the dry, which are connected by an earthenware pipe line of about a mile in length. There are many factors which have combined to make the Great Halviggan such a successful proposition. First among them is, of course, what Nature has devised in providing a valuable deposit of the very best clay. In regard to the mine's development, Messrs. John Haworth and Co. were most enterprising and encouraged the evolution of the recent modern improvements in the method of production. Then not the least among such factors has been the personal supervision of the local manager, Mr. Hart Nicholls, who has by his own relentless energy and the hearty co-operation of those employed under him materially assisted in raising the Great Halviggan Mine to the position and prominence it occupies in the trade. The firm's property covers an area of nearly 500 acres, and there is convincing evidence that the extensive deposit will last for many generations even at a more strenuous rate of production.

Plymouth Porcelain

By J. V. Hodgson,
of the Plymouth Museum and Art Gallery

WILLIAM COOKWORTHY was born at Kingsbridge, South Devon, in 1705, and his father, who died when he had barely reached the age of fourteen, left his family in rather poor circumstances; at any rate, William, obtaining a post as apprentice to Messrs. Beaven, chemists, of London, was obliged to proceed there on foot to take up the appointment. Without any other capital than a certain ability and a desire to do his work thoroughly, he soon secured the respect of his employers, and after his apprenticeship was over he set up as a wholesale chemist and druggist in Notte Street, Plymouth, under the name of Beaven and Cookworthy. He was of a Quaker family, but his religious opinions did not assert themselves for many years, when he became a minister of his sect. He was a man of many parts, learned, broad-minded, with varied interests, and with a strong determination to get to the bottom of anything he set his mind to, his concentration leading to many amusing stories of his so-called absentmindedness. Few men of his time had a wider knowledge of affairs, and his society and opinion were much sought after, his house becoming the rendezvous of the " intellectuals " of Plymouth. He was married in 1735, but his wife died after ten years of very happy married life, leaving him with five daughters. He himself attained the age of seventy-five, dying in 1780, after a long period of ill-health. His reputation in private life, as in his scientific and commercial career, was very widely respected by all, beloved by many, he may fairly be regarded as a truly great man.

Of Cookworthy as a " potter " comparatively little is known. While travelling about Cornwall, some time between 1745 and 1755, he discovered the existence of China Clay, or kaolin, and also China stone, or petuntse. As an enthusiast in matters pertaining to chemistry he attempted to make proper use of this discovery and, eventually, with financial assistance from Lord Camelford and others, he established a porcelain works at Plymouth in 1768. Not being a potter, help had to be obtained, and it is known that workmen were procured from the factory at Bow, and also that his co-religionist Champion, of Bristol, was called in, but at what period is uncertain. A natural hard-paste porcelain was thus made for the first time in this country, and the special peculiarities of the material had to be discovered and mastered. These might have baffled



EXAMPLES OF TEA POT AND JUGS.

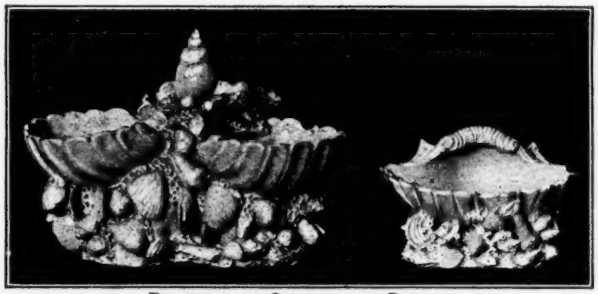
a better man than Cookworthy, but he persevered, and it cannot be denied that he achieved a very fair degree of success. One of his serious troubles was the question of fuel, and partly on this account, but probably, what was to him, more important, to be near his friend Champion, he opened up works at Castle Green, Bristol, but the Plymouth works were undoubtedly carried on for some little time longer. In 1773 Cookworthy definitely retired from the business, and the whole affair, including patents and all rights, were transferred to Champion, who maintained it for a few years longer.

These facts will explain the very close relationship that exists between Plymouth and Bristol porcelain.

Cookworthy was nothing if not an experimentalist, and a memorandum is extant showing that he biscuited his porcelain before decoration and glazing, decorated before and after glazing, or completed the article before any firing, with some comments on these separate processes.

The white china is rarely, if ever, marked, but most of the coloured work is so. The mark adopted is the " tinner's " mark, a combination of 2 and 4, usually in blue, but frequently in red. Over-glaze marks in either colour should be treated with caution. The prize of the collector is the inscribed piece in printed characters or in script, stating that it was " made at Mr. William Cookworthy's factory at Plymouth, 1770." The Museum possesses a pair of sauce boats, so marked and decorated in panel with the so-called exotic birds, in all probability derived from Worcester.

Plymouth china is about equally divided between ordinary



EXAMPLES OF ORNAMENTAL PIECES.

domestic ware and the more ambitious ornamental pieces, vases, statuettes, and the like. Of the former, sauce boats appear to be the most common at the present time, and there is little difficulty in obtaining specimens of the ordinary table ware, but it may be stated that only one plate and a single saucer (a shaped one) is known to the writer, and both of these are private property.

During the eighteenth century, though by no means confined to that period, it was the practice of certain workmen to pass from one factory to another, prompted possibly by a desire for change, but more probably by some financial inducement.

As has already been stated, Cookworthy obtained workmen from Bow, and in all probability other material assistance as well. The triple sweetmeat dish and two saltcellars figured are close copies of pieces made at Bow, if not actually from the same mould. Chelsea had a similar, though less defined, influence, while the local paper at Worcester contained advertisements for men to work at the newly-established factory at Plymouth, but as applications were to be made at Bristol there is that element of doubt as to which was meant that is so interesting to collectors. The influence of Worcester was unquestionably very great both in form and decoration ; the " exotic " birds were certainly imported from there, and certain pieces decorated with Chinese dragons and emblems in vivid colours and in panel are precisely alike in both factories.

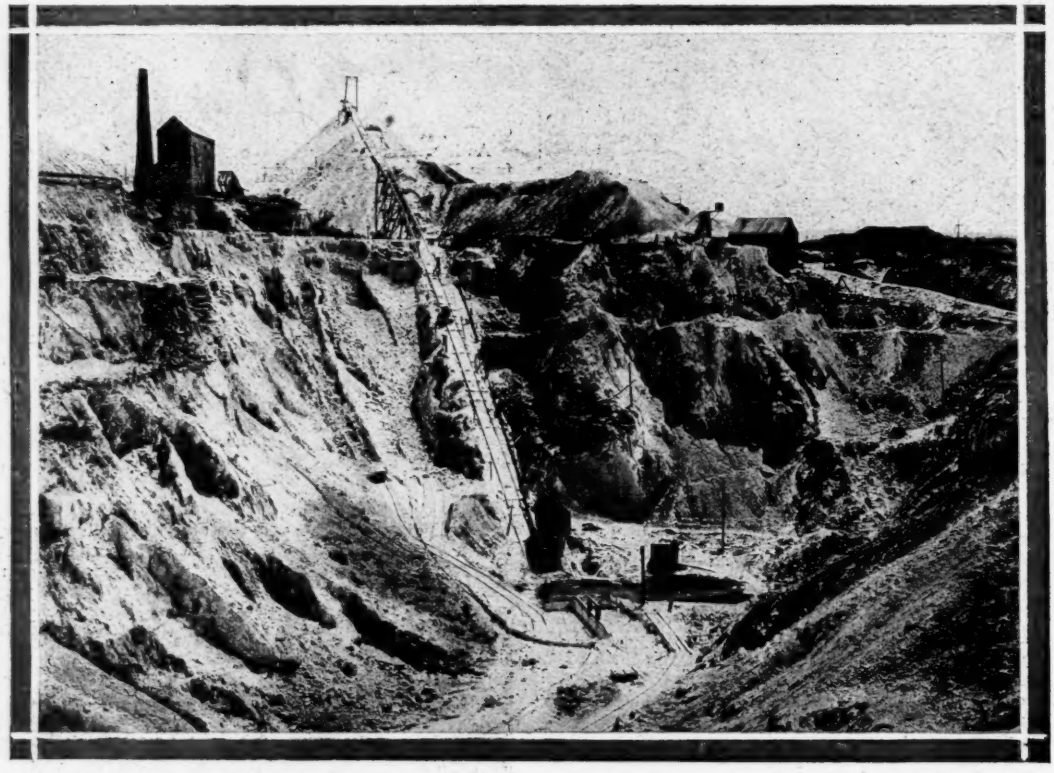
Many pieces of the purely decorative type are known in the natural white clay and also in colour. In the latter case the quality of the piece and also the colour varies to a large extent. It would appear from this that firing was a serious difficulty, and such pieces as escaped the dangers of the kiln were continued and suitably decorated ; with experience the defects decreased, the quality increasing proportionably, or more so. The statuettes and ornamental pieces were carefully modelled,

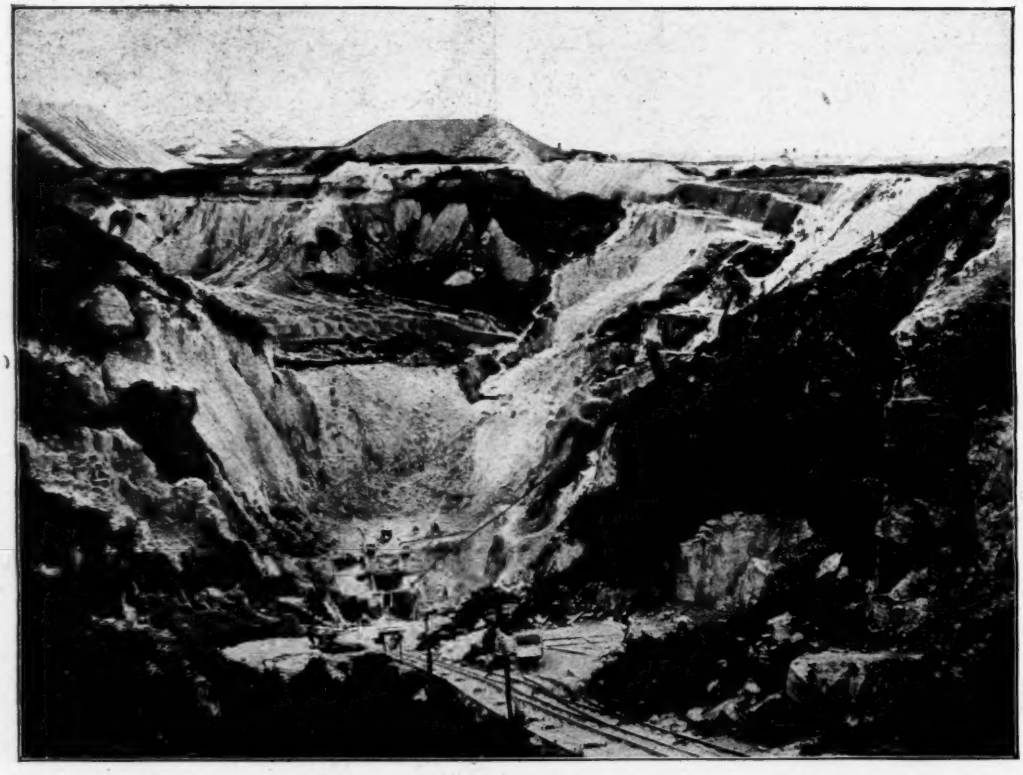
STATUETTE AND ORNAMENTAL PIECE.

but not infrequently became slightly deformed in the firing. One very noteworthy instance of this occurs in Captain Luxmoore's fine collection. It is a statuette representative of winter. The head of the lady is too inclined, and a dab of paste has been fired on to it to induce it to stand straight. This should be compared with a similar piece in the Schreiber Collection (Victoria and Albert Museum), and there ascribed to Bristol.

From such instances as this it is argued by some that Cookworthy, not being a potter, could not make a good piece ; all the good stuff being made at Bristol by the man who understood the business. There is perhaps some truth in this, but it must not be pushed too far. Numerous pieces are, and have been, lent to the Museum, the authenticity of which, beyond all question, shows that Cookworthy could and did make pieces which would have been a credit to any factory.

On the whole, Plymouth china does not enter into the front rank in the art world of porcelain ; it died as it were on the threshold of its existence, and Bristol was not able to obtain sufficient mastery over a very difficult problem to ensure a more commercial success.





Two of the Clay Pits of ENGLISH CHINA CLAYS, Ltd.

China Clay Notes and News

Ex-Mayor of Fowey's Golden Wedding

At the last meeting of the Fowey Town Council, a resolution of congratulation was passed to Mr. and Mrs. Simeon Rowe, who celebrated their golden wedding on April 1st. Mr. Simeon Rowe has for many years been a prominent public man in the Borough of Fowey, and was Mayor in 1922–23.

Czechoslovak Industries: Ceramics

The ceramic industry in Czechoslovakia is favoured with the existence in the country of most of the various raw material essential to its development, such as kaolin, and other clays, feldspar, limestone, marl, magnesium, quartz, suitable coal for fuel, etc. Some few materials such as gypsum and one or two chemical products have to be imported, but even this limited dependence on foreign material is gradually being diminished, as the hitherto unexploited mineral resources of the country (notably those of Slovakia) are being made available. Moreover, certain new raw material is found in sufficient quantity to permit of an export trade in such material itself—for example, kaolin for the porcelain and paper industries.

St. Austell Cottage Hospital Extension

The St. Austell Cottage Hospital has for some time had such a strain put upon its accommodation that the Committee, of which Mr. G. H. Grenfell is the Hon. Secretary, and Mr. Henry Stocker the Hon. Treasurer, has decided to make extensions estimated to cost £13,250. The Cottage Hospital has proved a great boon to the China Clay workers who have the misfortune to meet with an accident in the China Clay works, and it receives a large amount of its support from the China Clay workers and China Clay producers. The last-named, amongst others, have been the recipients of a special appeal for funds for the extension, and the following have so far responded: English China Clays, £210; Mr. J. C. Williams, Mr. J. W. Higman, Miss B. M. Lovering, Associated China Clays, Ltd., £105 each; Sir Francis Layland-Barratt, Mr. J. B. Fortesque, Mr. and Mrs. H. Stocker (jointly), £100 each; Messrs. H. D. Pochin and Co., Ltd., North Goonbarrow China Clay Co., £52 10s. each; St. Austell Guardians, Misses Stocker (Glenview), Mr. G. T. Petherick, £50 each; Mr. and Mrs. Grenfell (jointly), £30; Great Halviggan China Clay Co., £26 5s.; Mr. P. M. Coode and Mr. A. P. Coode, £50 each; Barclays Bank, Ltd., £21; Messrs W. Mutton and Co., £20; Cornish Mines Supplies Co., Ltd., £15 15s.

New China Clay Deposits Not Wanted

Occasionally there appear in the Press, what, on the face of them, appear to be inspired announcements of the discovery of new beds of China Clay, either in Cornwall or Devon, as though there was something remarkable about the fact. Previous to 1912, such announcements would be received with interest, and the possessors of the "setts" in which the Clay was found, were looked upon as fortunate people. That was at a time when the demand at times exceeded the supply, but nowadays, with the extensive development of new areas, since 1912, the production of China Clay has reached a height where the supply is greatly in excess of the demand. The greatest need of the China Clay industry is not the exploitation of new Clay areas, whose existence is well-known and discovered long ago, but the expansion of old markets and the finding of new ones to absorb the huge quantities of China Clay at present produced.

Like the rubber industry, the China Clay industry is suffering from over-production, and the areas of China Clay lands at present being developed by existing works can supply demands well over 1½ million tons per annum without any new works being developed. It is not likely that existing China Clay companies would pass over any promising proposition if the state of the industry and present production warranted its exploitation, for it is notorious in the China Clay industry that, with very rare exceptions, outsiders have not made a success of China Clay production.

The Development of "Clayopolis"

In the course of an address, dealing with unemployment relief works and housing under the St. Austell Rural District Council, before members of the South-Western Centre (Cornwall, Devon and Somerset) of the Sanitary Engineers' Association, who met at St. Austell on March 29th, Mr. F. H. Smith, the clerk, after referring to the 330 houses that had been erected in the district, under the Government Assisted Housing scheme—most of which are occupied by men engaged in the China Clay industry—stated that their experience with unemployment relief schemes had been even better than it was with housing. Thanks to the financial assistance of the Government they had been able to make that district the foremost from a local government point of view in Cornwall, for they had carried out forty-two different schemes, comprising sewerage, water, highway improvement, and stone quarrying, at a total cost of nearly £270,000.

In some cases they had received grants of 50 per cent. of the total cost, in others 65 per cent. of the loan and interest charges for half the loan period, and in water schemes, 50 per cent. of the interest on loans for five years. The people had benefited by the circulation of that money, and had been saved from the degradation of the acceptance of poor relief. But for these schemes, he estimated that last winter the cost to the ratepayers would have been from 2s. 6d. to 5s. in the £ extra for poor relief. The output in return for the money expended on the whole had come up to the most sanguine expectations. It was never expected to get 100 per cent. results, but in many cases they had got fully 75 and 80 per cent., while in a few they only reached 70 or 60 per cent. As a result of the schemes, houses were going up as fast as possible, for scores of admirable building sites had been opened up.

What were those improvements costing the ratepayers? Ratepayers said their rates were high; did they ever know ratepayers who admitted that the rates were low? For the year ended March 31st the rates were: County, 4s. 8½d.; poor, 2s. 0¾d.; Rural District Council, 4s. 3d.—total 11s. In addition there were special expenses on particular parishes, but the average total rates in the district did not exceed 12s. 6d. There were lots of ratepayers in towns and cities who would like to find work and a vacant house in the district.

G.W.R. Road Motor Bus Accident

One of the most distressing misfortunes that have occurred in the China Clay district for some years was enacted on Saturday evening, March 29th, when a Great Western Railway road motor-'bus, whilst proceeding from St. Austell Station to Par, *via* Charlestown, got out of control. The bus was crowded, and when descending the hill to Charlestown village the brakes failed to act, and created a panic amongst the passengers. With commendable coolness the driver steered the bus to the water-table, with the idea of jamming the wheels against the kerbing, which, happily, resulted in checking the speed and eventually bringing the bus to a standstill otherwise there was no alternative but the docks just a short distance beyond. Mr. George Peters Michell, who is well known in the China Clay industry, and was sitting in front of the bus, jumped out, but, failing to clear the water-table, both legs were caught by the rear wheel of the bus and crushed to pulp. He was conveyed by ambulance to the Cottage Hospital, where he succumbed to his injuries in the early hours of the following Sunday morning. The whole district has been deeply stirred, and the bereaved widow, mother and sister have been inundated with messages of sympathy. Mr. Michell was a grandson of the late Mr. Woodman Peters, who was for many years a vigorous pioneer in the China Clay industry and a principal of the firm of Messrs. Parkyn and Peters, of St. Austell. The deceased was for a time attached to the St. Austell office of that firm. It will be remembered that quite recently Mr. J. W. Higman, jun., the local director of Messrs. H. D. Pochin and Co's. China Clay mining operations at St. Austell, married Miss Dorothy Michell, the only sister of the deceased. The interment in the St. Austell Cemetery on the following Wednesday morning bore another striking manifestation of the sorrow so widely expressed by a vast assemblage of sympathetic friends from the district. The mourners included Mr. J. W. Higman, jun. (brother-in-law), Mr. Andrew Peters and Mr. J. Lewis Peters (uncles), and Captain W. P. Langmaid and Mr. J. Perry (friends). Among the numerous representative bodies present were Mr. T. H. Williams, J.P. (chairman of the St. Austell Urban Council), Mr. F. W. Jenkin, J.P., C.C. (Chairman of the St. Austell Rural District Council), Mr. A. F. Davey (Station-master, St. Austell), Driver A. J. Wilkinson (who was in charge of the 'bus), Mr. Frank Parkyn (head of the firm of Messrs. Parkyn and Peters). The Revs. J. Johns and W. P. Wilkes (Wesleyan) officiated.

Unemployment Relief Works

A very important visit was made to the China Clay town of St. Austell on Saturday, March 29, by the South Western Centre of the Sanitary Inspectors' Association. At the morning session the clerk to the St. Austell Rural District Council gave a paper on "Unemployment Relief Works and Housing in the St. Austell District." Mr. Smith pointed out that under the assisted housing scheme they had erected 330 houses out of a minimum requirement of 600. With regard to unemployment, Mr. Smith mentioned that through the financial assistance of the Government they had been able to make St. Austell the foremost district in the county, for they had carried out 42 different schemes at a total cost of nearly £270,000 for sewerage, water and highway improvements. Mr. W. H. Ennor, of Truro, said it was perfectly evident from what the St. Austell Rural District Council had achieved that they were living up to their reputation as the most progressive council in the county. Whilst in the vicinity of St. Stephen's reviewing the relief works, the visitors, accompanied by Mr. F. L. Smith, LL.B., clerk to the Council, visited the works of the Carpalla United China Clay Co., an auxiliary to the firm of Messrs. Spicers, Ltd., of 19, New Bridge Street, London, E.C. The production of China Clay provided quite an interesting diversion to the day's schedule, as many of them had not been initiated into the white industry. After visiting the pit known as Wheal Binn the visitors displayed considerable interest in the various processes, the mica drags, settling pits, tanks, and large dry. This mine is equipped with the very latest device except that it still retains the Cornish engine as its motive power producer. The operations throughout were greatly admired, and the hearty thanks of the assembled guests were expressed to the Company for the opportunity and facilities granted to them on that occasion.

CAPT. PAUL PETERS.

Capt. Paul Peters

The China Clay industry has lost, by the death of Captain Paul Peters, another of its old devotees. For over 60 years Captain Peters had been connected with China Clay production in the neighbourhood of St. Austell, and practically saw its course of progress from small dimensions to the highest peak of output achieved, and also witnessed vast improvements in the use of motive power and mechanical appliances. For near 50 years Captain Peters was in charge of the Carran-Carrow Works for the West of England and Great Beam China Clay Co., Ltd., a company recently absorbed by the English China Clays, Ltd., from which he retired in 1919. Very few leaders of industry were regarded with more esteem by the men and the firm he served under than the deceased, and throughout the neighbourhood his honourable life and transparent character were venerated. Deceased, who was 77 years of age, had been identified with the St. Austell Wesleyan Methodist Church for over 30 years. The funeral took place in the St. Austell Cemetery, and before the interment a service was conducted in the St. Austell Wesleyan Church by the Superintendent, the Rev. J. Johns, who in a brief address paid a very high tribute to the life and character of the deceased. The bearers, who were chosen by the deceased, were six of the oldest workers at Carran-Carrow China Clay Works: Messrs. W. Hooper, C. Welch, J. Perrit, W. H. George, W. Harris and J. Barry. Captain Paul Peters was a brother of the late Mr. Woodman Peters, one of the principals of Messrs. Parkyn and Peters.

St. Austell Cottage Hospital

The decision of the General Committee of the Cottage Hospital at St. Austell to provide increased accommodation appears to be meeting with great success, judging by the generous subscriptions that have been received by the Hon. Secretary, Mr. G. H. Grenfell. Among the China Clay producers and others who have contributed are:—The English China Clays, Ltd., £210; Mr. J. W. Higman, Miss B. M. Lovering, The Associated China Clays, Ltd., £105 each; Sir Francis Layland Barratt, Bart., Mr. J. B. Fortescue, Mr. and Mrs. H. Stocker (jointly), £100; Messrs. H. D. Pochin and Co., Ltd., Messrs. The North Goonbarrow China Clay Co., £52; Misses A. and R. Stocker, "Glenview," £50; Mr. and Mrs. G. H. Grenfell, £30; The Great Halviggan China Clay Co., £26 5s.; Messrs. P. M. and A. P. Coode, £50 each; Messrs. W. Mutton and Co., Charlestown, Cornish Mines Supplies, Ltd., £15 15s. The extension is estimated to cost £3,250.

The Late Mr. E. T. T. Whitford-Hawkey

The death of Mr. E. T. T. Whitford-Hawkey, which occurred at Bospolvans, St. Columb, has not only removed a notable resident and a prominent member of the legal profession, but the China Clay industry has lost one who had evinced great interest in its progress. Mr. Whitford-Hawkey's father was a director of the late West of England and Great Beam China Clay Co., Ltd., a group of mines now in the English China Clays, Ltd., and for a long period the firm were solicitors for the company.

Fowey and St. Just

In a recent issue, the *Western Morning News* says:—The very sheltered condition of the estuary is a great advantage in favour of Fowey, where loading can be undertaken in the roughest weather. Another fact which appeals to shippers is that the charges are the lowest of any other port in the kingdom. Nevertheless, the practical realisation of the St. Just scheme will be welcomed throughout the China Clay industry as an alternative to Fowey, especially for the loading of big cargoes for the American market in the summer months, with the proviso that vessels can be loaded and dispatched as expeditiously and economically as at Fowey at present. The competition that would then be set up would operate favourably to the China Clay industry, and might lead to an extension in the overseas trade.

The China Clay producers are following with keen interest the efforts by the Prime Minister to settle the European problems on a firm basis, for the result of restored trade conditions in France, Germany, and Russia would in the near future be reflected in a very considerable increase in the demand for China Clay from those parts.

Clay in the United States

The United States Government report on the uses of clay in the United States during the past years speaks enthusiastically of "the general increase in prosperity," and its effect on the clayworking industries, the amount of clay used being 52 per cent. more than in the previous year. Fireclay, which constitutes 63 per cent. of the total clay sold, created a record, but stoneware clay appears to have made no progress over the previous years. China Clay showed an increase of 69 per cent. on previous years, and more than double that of any year prior to 1912. This shows the great determination on the part of the Americans to make use of their own China Clays and kaolins instead of importing all they require from Cornwall as hitherto. Bentonite, which is allied to clay and fuller's earth, yet differs greatly from both, is being increasingly used for clarifying oils.

English China Clay's Report

A further good recovery is disclosed by the report for 1923 of English China Clays, Ltd., the net profit amounting to £91,918, against £62,342 for the preceding year and a loss of £32,102 for 1921.

A final dividend of 2½ per cent. is declared on the Ordinary shares, making 4½ per cent. for the year, against nil for the previous two years.

It is further proposed to place £15,000 to general reserve, leaving £13,987 to be carried forward in comparison with £15,354 brought in.

A greater volume of business is reported both for home and export, but the demand for China Clay, the directors state, is still below pre-war levels.

Fowey Article

Mr. Carter's article on Fowey will continue in our next issue.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Fowey Shipping—March, 1924

Arrived.		Name.	Sailed.	Destination.
Mar. 1,	S.S.	*Letty*	Mar. 5,	Lancaster
Mar. 1,		*Hilda*	Mar. 2,	Charlestown
Mar. 2,	S.S.	*Marnix*	Mar. 10,	Antwerp
Mar. 3,	M.S.	*Laanemaa*	Mar. 8,	Brussels
Mar. 4,	S.S.	*Ivytown*	Mar. 8,	Gravesend
Mar. 5,	S.S.	*Cervantes*	Mar. 12,	Genoa
Mar. 5,		*Camille*	Mar. 15,	Granville
Mar. 5,	S.S.	*Moss Rose*	Mar. 8,	Preston
Mar. 5,	S.S.	*Falmouth Castle*	Mar. 10,	Weston Point
Mar. 6,	S.S.	*Freeland*	Mar. 15,	Liverpool
Mar. 6,	S.S.	*Mercator*	Mar. 17,	Genoa
Mar. 6,		*Ellen*	Mar. 22,	Leith
Mar. 6,	S.S.	*Breadale*	Mar. 18,	Ridham
Mar. 6,	S.S.	*Ferndene*	Mar. 15,	Antwerp
Mar. 6,	M.V.	*Haukur*	Mar. 18,	Bo'ness
Mar. 6,	S.S.	*Mersey*	Mar. 15,	Grimsby
Mar. 6,		*Hilda*	Mar. 15,	Antwerp
Mar. 8,	S.S.	*Achille Bayart*	Mar. 17,	Harburg
Mar. 9,	S.S.	*Eika*	Mar. 20,	Preston
Mar. 9,		*Martin Misson*	Mar. 22,	Mevagissey
Mar. 11,	S.S.	*Lancashire*	Mar. 18,	Fleetwood
Mar. 12,	S.S.	*Hontestroom*	Mar. 18,	Amsterdam
Mar. 12,	S.S.	*Calluna*	Mar. 20,	Brussels
Mar. 13,	M.V.	*Fenja*	Mar. 18,	Karlskrona
Mar. 13,		*Mary Barrow*	Mar. 21,	Charlestown
Mar. 14,	S.S.	*Daisy*	Mar. 19,	Lancaster
Mar. 14,	S.S.	*Brier Rose*	Mar. 19,	Preston
Mar. 15,	S.S.	*Pansy*	Mar. 20,	Preston
Mar. 15,	S.S.	*Mayrix*	Mar. 27,	Antwerp
Mar. 15,	S.S.	*Cromwell*	Mar. 19,	Weston Point
Mar. 15,	M.V.	*Katie*	Mar. 19,	Par
Mar. 15,	S.S.	*Abercraig*	Mar. 20,	Guernsey
Mar. 16,	S.S.	*Prutan*	Mar. 21,	Terneuzen
Mar. 16,	S.S.	*Miriam Thomas*	Mar. 21,	Weston Point
Mar. 16,	M.V.	*Young Fox*		
Mar. 17,	S.S.	*Aymeric*	Mar. 27,	Portland, Me
Mar. 17,	S.S.	*Florentino*	Mar. 21,	Genoa
Mar. 17,	S.S.	*Sagaporack*	Mar. 26,	New York
Mar. 17,	S.S.	*Falmouth Castle*	Mar. 21,	Runcorn
Mar. 18,	S.S.	*Leaside*	Mar. 27,	Rouen
Mar. 18,		*Elsa*	Mar. 20,	Par
Mar. 18,		*Mary Ann*	Apr. 2,	Weston Point
Mar. 18,	S.S.	*Condor*	Mar. 24,	Antwerp
Mar. 19,	S.S.	*Wheatsheaf*	Mar. 26,	Preston
Mar. 19,	S.S.	*Alice*	Mar. 25,	Runcorn
Mar. 21,	S.S.	*Multistone*	Mar. 26,	Newcastle
Mar. 21,	S.S.	*Lisbet*	Mar. 27,	Bo'ness
Mar. 22,	M.V.	*Ilse*	Mar. 27,	Dundee
Mar. 23,	S.S.	*Sweden Maru*	Apr. 5,	Baltimore
Mar. 24,	S.S.	*Heatherlea*	Mar. 28,	Antwerp
Mar. 25,	M.V.	*Hetty*	Mar. 31,	Rochester
Mar. 25,	S.S.	*Moss Rose*	Mar. 27,	Manchester
Mar. 26,	S.S.	*S. B. Lund*	Mar. 29,	Boston, Mass.
Mar. 26,	S.S.	*Marie Siedler*	Mar. 28,	Odense
Mar. 26,	M.V.	*Katie*	Mar. 31,	Rochester
Mar. 27,	S.S.	*Dragoon*	Mar. 29,	Liverpool
Mar. 28,	S.S.	*Meuse*	Apr. 3,	Passages
Mar. 28,	S.S.	*Guelder Rose*	Apr. 2,	Llanelly
Mar. 28,		*Gauntlet*	Apr. 7,	Weston Point
Mar. 28,	S.S.	*Enid Mary*	Apr. 3,	Cardiff
Mar. 29,	S.S.	*Teespool*		
Mar. 30,	S.S.	*Wreathier*	Apr. 5,	Llanelly
Mar. 30,	S.S.	*Zaanstroom*	Apr. 4,	Amsterdam

Par Harbour Shipping—March, 1924

Arrivals

Date.		Vessel.	From.
Mar. 1,	S.S.	*Castlerock*	Jersey
Mar. 2,	S.S.	*Magrix*	Hull
Mar. 4,	S.S.	*Balmyle*	St. Ives
Mar. 4,	S.V.	*John Gibson*	Falmouth
Mar. 4,	S.S.	*Oak*	Plymouth
Mar. 5,	S.V.	*Leonard Piper*	Plymouth
Mar. 6,	S.V.	*Jantine Fennigine*	Charlestown
Mar. 8,	S.V.	*Lilla*	Plymouth
Mar. 8,	S.V.	*Ovenbeg*	Dartmouth
Mar. 13,	S.S.	*Robrix*	Hull
Mar. 16,	S.V.	*Guiding Star*	Port Mavis
Mar. 19,	M.V.	*Katie*	Rochester
Mar. 21,	S.V.	*Elsa*	Runcorn
Mar. 21,	S.S.	*Grosvenor*	Point of Ayr
Mar. 21,	S.S.	*Tanny*	Portishead
Mar. 21,	S.S.	*Heatherlea*	Hull
Mar. 22,	S.S.	*Schwan*	Weymouth
Mar. 23,	S.S.	*Marlie*	Barry
Mar. 24,	S.S.	*Nancy Thomas*	Truro
Mar. 25,	S.S.	*Cheviot*	Penzance
Mar. 27,	S.V.	*Emanuel*	Bremen
Mar. 29,	M.V.	*May Blossom*	Fowey
Mar. 29,	S.V.	*Clymping*	Portsmouth

Sailings

Date.		Vessel.	Destination.
Mar. 4,	S.V.	*Venturer*	Gravelines
Mar. 5,	S.S.	*Multistone*	Sunderland
Mar. 5,	S.S.	*Castleroch*	Penarth
Mar. 5,	S.S.	*Magrix*	Gravesend
Mar. 6,	S.V.	*Irish Minstrel*	Western Point
Mar. 7,	S.S.	*Balmyle*	Western Point
Mar. 7,	S.S.	*Oak*	Lame
Mar. 16,		*Leonard Piper*	Rochester
Mar. 17,	S.V.	*Jantine Fennigine*	Ghent
Mar. 18,	S.V.	*Rosina*	Queenborough
Mar. 18,	S.V.	*Regina*	Poole
Mar. 18,	S.S.	*John Gibson*	London
Mar. 18,	S.S.	*Robrix*	Rochester
Mar. 19,	S.V.	*Pet*	Gravelines
Mar. 21,	S.V.	*Emily Warbrick*	Runcorn
Mar. 22,	S.V.	*Lilla*	Western Point
Mar. 24,	S.S.	*Heatherlea*	Fowey
Mar. 25,	M.V.	*Hetty*	Rochester
Mar. 25,	S.S.	*Tanny*	Lydney
Mar. 25,	S.S.	*Marlae*	Teignmouth
Mar. 26,	M.V.	*Katie*	Rochester
Mar. 26,	S.S.	*Grosvenor*	Barrow
Mar. 27,	S.S.	*Nancy Thomas*	Runcorn
Mar. 28,	S.S.	*Cheviot*	Garston

Charlestown Shipping—March, 1924

Arrivals

Date.	Vessel.	From.
Mar. 1.....	*Lutona*	Poole
Mar. 1.....	*James Postlewaite*	Mevagissey
Mar. 2.....	*Hilda*	Plymouth
Mar. 4.....	*Francis and Jane*	Truro
Mar. 8.....	*Meteore*	Trequie
Mar. 12.....	*Jolly Basil*	Penryn
Mar. 16.....	*Weitze*	Exeter
Mar. 17.....	*Dunleith*	Penryn
Mar. 19.....	*Glenbrook*	Penzance
Mar. 21.....	*Mary Barrow*	Newport
Mar. 23.....	*Primula*	Newlyn
Mar. 31.....	*Martin Nisson*	Mevagissey
Mar. 31.....	*Goldfinch*	Southampton

Sailings

Date.	Vessel.	Destination.
Mar. 4.....	*Lady Daphne*	Rochester
Mar. 4.....	*Lovistic*	Nantes
Mar. 5.....	*Lutora*	Rouen
Mar. 17.....	*Weitze*	Berwick
Mar. 17.....	*Jolly Basil*	London
Mar. 18.....	*Meteore*	St. Malo
Mar. 21.....	*Adelaide*	Rochester
Mar. 21.....	*Jas. Postlewaite*	London
Mar. 21.....	*Francis and Jane*	London
Mar. 21.....	*Dunleith*	Preston
Mar. 21.....	*Glenbrook*	Tayport
Mar. 26.....	*Primula*	Kirkcaldy

March China Clay Deliveries

FOLLOWING two poor months affected by the strikes, March tonnage made a big advance, showing an increase on the February figures alone of over 27,000 tons, bringing the total for the first three months of the year to over 190,000 tons, compared with over 196,000 tons for the corresponding three months last year. There has been a falling off of the briskness at Fowey that characterised March, but the past month has contributed

considerably to making up the leeway left by the small totals of January and February.

Details :—

Port.	Tonnage.
Fowey (including 3,495 tons China Stone)...	63,075
Par (including 651 tons China Stone)	5,051
Charlestown	1,713
Plymouth	1,065
Looe	157
By rail to destinations	5,894
Total	76,955

—against 51,740 for February

China Clay Exports

RETURN showing the Exports of China Clay (including Cornish or China Stone), the produce or manufacture of the United Kingdom from the United Kingdom to each Country of Destination registered during the month ended March 31st, 1924.:—

Country of Destination.	Quantity Tons.	Value. £
Finland	30 ..	89
Sweden	348 ..	1,169
Norway	1 ..	5
Denmark	3 ..	25
Germany	1,288 ..	3,252
Netherlands	1,369 ..	2,920
Belgium	7,312 ..	14,683
France	1,861 ..	4,182
Switzerland	10 ..	20
Spain	311 ..	1,645
Italy	3,236 ..	8,512
China	8 ..	64
Japan	2 ..	7
United States Atlantic	27,484 ..	64,274
United States Pacific.....	212 ..	628
Mexico	275 ..	1,254
Irish Free State	10 ..	21
Palestine	— ..	1
Bombay *via* other Ports....	428 ..	1,688
Madras	10 ..	40
Bengal	129 ..	517
Victoria	5 ..	70
New South Wales	21 ..	97
Canada Atlantic	182 ..	435
Total	44,535 ..	105,598
Add to correct February Published Account.....	— ..	630
	44,535 ..	106,228

A return showing the Registered Imports of China Clay (including China Stone) into Great Britain and Northern Ireland, from the several countries of consignment during the month of January, 1924.

Country whence consigned.	Quantity. Tons.	Value. £
Portugal	2	10
Channel Islands	140	210
Total.....	142	£220

February, 1924.

Country whence consigned.	Quantity. Tons.	Value. £
Germany	15	37
Czecho-Slovakia	40	77
Total	55	£114

Par Harbour Tide Table, April, 1924

(Greenwich Mean Time throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Tuesday.....	1	3.18	3.47	11. 3
Wednesday	2	4.11	4.34	12. 1
Thursday.....	3	4.55	5.16	12. 8
Friday	4	5.34	5.53	12.11
Saturday	5	6.10	6.27	13. 1
SUNDAY	6	6.42	6.57	13. 0
Monday	7	7.11	7.27	12. 8
Tuesday.....	8	7.41	7.56	12. 2
Wednesday	9	8.13	8.27	11. 7
Thursday.....	10	8.43	9. 0	10.11
Friday	11	9.20	9.41	10. 0
Saturday	12	10. 7	10.36	9. 3
SUNDAY	13	11.11	11.51	8. 8
Monday	14	—	0.34	8. 9
Tuesday.....	15	1.15	1.54	9. 8
Wednesday	16	2.28	2.58	10.10
Thursday.....	17	3.26	3.51	12. 1
Friday	18	4.13	4.36	13. 2
Saturday	19	4.59	5.20	13.10
SUNDAY	20	5.43	6. 5	14. 1
Monday	21	6.28	6.48	14. 3
Tuesday.....	22	7. 9	7.30	14. 0
Wednesday	23	7.54	8.17	13. 5
Thursday.....	24	8.40	9. 4	12. 4
Friday	25	9.29	9.56	11. 1
Saturday	26	10.26	11. 0	10. 1
SUNDAY	27	11.40	—	9. 5
Monday	28	0.22	1. 4	9. 9
Tuesday.....	29	1.44	2.18	10. 5
Wednesday	30	2.40	3.18	11. 4

H. L. VICARY, Harbour Master.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

COOKE (HENRY) AND CO., LTD., Richmond (Yorks), paper manufacturers.—Registered March 27th, £500 mortgage, to Miss E. C. Deighton, Gilling, near Richmond ; charged on Albert House, 10, Hurgill Road, Richmond. *Nil. July 18th, 1923.

FALLS PAPER MILL CO., LTD., Beetham.—Registered February 28th, £50,000 debenture, to W. Stansfield, Commonside, Ansdell, and another ; charged on property at Beetham, also general charge. *——. January 4th, 1924.

LOWER LANSALSON AND CANDLEDOWN CHINA CLAY CORPORATION, LTD. (late LOWE LANSALSON CHINA CLAY CO., LTD.).—Registered February 27th, £2,800 £2,000 and £500, £500 debentures, part of £65,000 ; general charge. *£31,100. December 31st, 1922.

MILNES (S.) AND SONS, LTD., Bradford, paper manufacturers.—Registered February 27th, £1,700 mortgage, to Building Society ; charged on 42 and 42A, York Place, Leeds. *£1,080. January 15th, 1923.

PEEBLES (A. M.) AND SON, LTD., London, E.C., paper makers.—Registered March 21st, Trust Deed dated March 5th, 1924, supplemental to Trust Deeds dated September 15th, 1896, and August 30th, 1916, securing £100,000 1st debenture stock, of which £98,680 is outstanding), securing £40,000 debenture stock ranking *pari passu ;* charged on properties at Oswaldtwistle, etc., also general charge. *£128,680. January 3rd, 1924.

London Gazette

Companies Winding Up Voluntarily

HYDE PAPER MANUFACTURING CO., LTD.—M. C. Rogers, Water Street, Hyde, chartered accountant, appointed liquidator.

KINGMOOR BRICK AND TILE CO., LTD.—A. E. Vipond, 5, Old Post Office Court, Carlisle, appointed liquidator.

MORA PAPER CO., LTD.—Henry Steele, 25, Brazennose Street, Manchester, incorporated accountant, appointed liquidator.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests. Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions, and other business should be sent to the Manager, "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

Prospects for 1924

WILL 1924 be the best China Clay trade year since 1914? There are many indication that this will be the case, especially if the prospects which now give promise of fulfilment are realised during the year. Apart from prospects merely, the healthiness shown by the export trade during the first three months of the year, despite hampering conditions on this side through the strikes in January and February, has been such as gives ground for the belief that there will be a progressive improvement as the year advances.

While the total deliveries made during the three months to the end of March show a falling off of 6,000 tons compared with the corresponding three months of last year, the export trade during the same period shows the gratifying increase of 20,000 tons. The United States of America have been mainly responsible for this, their shipments this year for the three months having been 87,471 tons against 69,419 tons last year. Of the European countries, Belgium has shown the greatest progress, having exceeded their last year's three months' tonnage by nearly 4,500 tons. Germany has made an increase of under 1,000 tons, Spain an increase of 1,000 tons, but Italy is down about 800 tons, while Scandinavia and the Netherlands are each down about 1,000 tons. The Indian markets show a slight increase. The markets in South America, though small, show a slight increase on the three months, as does also Canada. The exports to Denmark are small, the returns showing imports of 642 tons, against 836 tons last year. Lack of expansion of the markets in this country is probably due to the development of their own domestic clays, the competition from which is being felt in some of the Northern markets for English China Clay.

In analysing the trade for the first three months of this year, one must always have in mind the dislocation of business in the first two months of the year through strikes at home, and the adverse conditions prevailing on the Continent during the same period through the slump in the exchanges, which militated greatly against China Clay business in Germany, France and Belgium particularly.

In a comparison of values as regards the export trade, it will be seen that the average price of the China Clays sold, which of course include all grades from the cheapest to the most expensive, work out at about 49s. per ton, approximately the average price ruling in the first three months of 1923 also.

Here are the figures showing the trend of trade for the first three months of this year, together with the figures of the corresponding three months of last year :—

TOTAL DELIVERIES.

	1923. Tons.	1924. Tons.
January	74,284	60,435
February	60,954	51,740
March	61,452	78,342
Total	196,690	190,517

EXPORT TRADE.

	1923. Tons.	1923. Value. £	1924. Tons.	1924. Value. £
January ..	29,642	73,819	71,833	173,174
February ..	63,406	150,353	32,637	84,527
March ..	35,344	89,385	44,535	106,228
Total ..	128,392	£313,557	149,005	£363,939
Home ..	68,298	—	41,512	—
	196,690	—	190,517	—

A gratifying feature of these statistics is the expansion they reveal in the export trade. The following list shows the tonnage and values of the exports to individual countries for the three months :—

Country	1923. Tons.	1923. Value £	1924. Tons.	1924. Value. £
U.S.A.	69,419	167,880	87,471	206,312
Belgium ..	12,588	26,005	17,000	34,949
France	10,747	23,163	9,344	20,652
Italy	8,734	20,556	7,905	22,232
Netherlands ..	8,176	20,583	7,112	18,527
Scandinavia ..	6,382	11,112	5,391	10,453
India	5,234	20,956	5,503	21,842
Spain	3,054	10,572	4,150	12,929
Germany ..	2,196	6,025	3,066	8,198
Denmark ..	836	2,284	642	2,007
South America ..	449	2,347	626	2,841
Canada	164	467	387	844
Australia and West Indies ..	85	602	61	499
Japan, China, Switzerland, Portugal, Irish Free State, etc.	228	1,000	73	244

Included in the figures for Scandinavia are shipments made to Finland and Esthonia. It will be noted that there is no record of any direct shipments to Russia.

What the settlement of the European question as it affects Russian and German trade, as well as the countries adjacent thereto, will mean to the China Clay industry is incalculable. Not only would such a consummation enable the countries concerned to revive their own industries in

which they consumed enormous qnantities of China Clay before the War, but it would have such an effect of restoring the exchanges that English China Clays would not be at such a disadvantage as they are now in meeting the competition from foreign clays which can now be exported from one European country to another on such favourable terms to themselves. It is only necessary for one to study the map of Europe to see that Czecho-Slovakia, where good bleaching clays are produced which compete with our clays in Central Europe, is a greater distance from the manufacturing centres of Northern Germany and Southern France and Belgium than the home of English China Clays is from these markets, while transport of our clays is largely by the cheaper means of water than those of Czecho-Slovakia, which has expensive rail transport to contend with.

The abnormal exchanges have enabled Czecho-Slovakian and other clays to counteract these transport handicaps, but when things are put on a more normal commercial basis on the Continent, as a result of the settlement of the reparations and other problems, such as prevailed before the War, there will be very distinct hopes that the English China Clay producers will be able to recover to a greater extent than has yet been possible their old European markets, and expand them as they have succeeded in doing those in America.

In short, with more settled conditions in Europe in the near future there is every reason to hope that Russia will in time resume buying the large quantities of China Clay which she did before the War, amounting on the average to 40,000 tons per annum, and that Germany will enormously increase her demands from what they are at present to something approaching the pre-War figure of 80,000 ton per annum. These improved conditions would also make it more economical for such countries as France, Belgium and Scandinavia to purchase our clays instead of buying foreign clays to the extent they have been doing in consequence of the exchange operating in their favour.

Despite the adverse conditions under which English China Clay producers have been labouring in pushing business on the Continent, it is satisfactory to note the improvement apparent already, and there is every reason to expect very greatly enhanced business when the European tangle has been straightened out.

The Associated China Clays

As we have shown, a distinctly better feeling with regard to the future prospects of the China Clay industry is manifest amongst all producers.

The fact that the members of the Association have settled their differences, and have decided to continue the working of its rules and regulations, has no doubt much to do with a more optimistic feeling.

Last month's issue of this journal was in the press before the decision of the Association to continue arrived, and we only had time to record the fact, though we have consistently urged the policy of remaining loyal to its principles.

A fatal step has been averted, thanks largely to some of the members' efforts, who, had such a catastrophy occurred, would have been better able to weather the storm than others who were not so wholehearted in their support.

The rules of such an association are framed upon democratic lines for the good of all concerned, and for its smooth working must have the loyal support of all its members; and now that differences have been settled we trust that the Association has many years of useful work in front of it, and that trade which has been none too good in the past few years may have a quick and lasting recovery.

We would also urge those few concerns which have stood aloof from the Association seriously to consider their position. At present they reap all the advantages of the working of the Association without giving it their support, though it must be evident to them that but for such an organisation their position would not be an enviable one. History shows in other industries that there always comes a time when such concerns are glad to become members, but they are not then welcomed by members who have stood the brunt of the fight.

The smaller firms sometimes feel that they will do better for themselves by not joining such an association, and that they will not be fairly treated by the larger firms. The working of the Associated China Clays, Ltd., has shown that this is emphatically not so. Rules have been made which give, as far as possible, equity and justice to all.

Is it not better, then, for firms outside the Association to throw in their lot with such a trade protection society now rather than later on, when it may not be so easy to do so?

If such producers could be made to realise their responsibilities there would be an even better feeling as to future prospects.

This can only be achieved by close co-operation of all concerned, and it is very much to be hoped that this year may see every producer a member of the Association, an association, "the principles of which are not those of limited output and inflated prices," but are formed for the benefit of the trade as a whole.

The Great Exhibitions

THE British Industries Fair, at the White City, Shepherd's Bush, which was held from April 28 to May 9, and organised by the Department of Overseas Trade, was one of the successful exhibitions which do so much to encourage the trade of the Old Country. But all exhibitions are of course dwarfed by the British Empire Exhibition at Wembley, where the wealth and resources of five continents are gathered within its boundaries.

Such exhibitions should be studied by both employers and employees, and the China Clay industry will find very much of interest to all who visit it. Paper-making, pottery, textile and chemical manufacture—all users of China Clay—are represented at Wembley. Many employers in the country have given their workpeople opportunity to visit Wembley, and the China Clay industry has not been behind in this matter, special facilities being offered by at least one firm in the St. Austell district to visit Wembley at very reduced rates, which will mean an outlay of many hundreds of pounds to the employers.

One of the first places to be visited at Wembley will probably be in the Malay exhibit, and here will be found a large amount of China Clay, which, it is claimed, is equal to the best Cornish China Clay.

We shall be interested to have our readers' opinions upon this claim

Gospel of Salesmanship

"BE AGREEABLE," reads the first of Dr. Frank Crane's "Ten Commandments of Salesmanship." The command is so self-evident as almost to seem superfluous. "Any salesman ought to be agreeable," we think. We assent, mentally, to the proposition and then go on to the next commandment, without asking ourselves, "Are we being really agreeable to our customers—or as agreeable as we ought to be?"

If we are not agreeable to our customers, we have lost the first move in the game of salesmanship. As in chess, the first bad move may mean the loss of the game.

An agreeable, merry, human fellow who comes into the office with a smile and a chuckle, who shakes hands as if he likes you, and makes the world seem a pretty good place after all, is himself the best recommendation for his goods. You know such a chap isn't worrying about his prices or deliveries. He is all right. He creates confidence. He makes you feel he is the best possible man to do business with.

The really agreeable man is a man with a clear conscience and an open mind, who is not worrying about himself, and therefore has time to be interested in people and in you.

A mean man is seldom agreeable. He is too selfish.

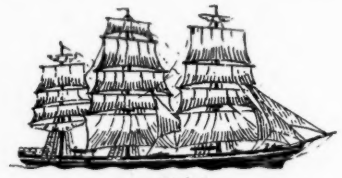
Fowey

By John P. Carter

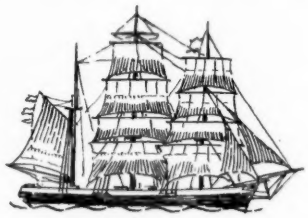
To say one will write about ships sounds very simple, but how difficult to know where or how to start! What an infinite variety come to Fowey, and how the types have altered in the past thirty years! How interesting a day can be spent at Fowey among the ships! It is one of never-failing pleasure to our visitors, young or old, to take them on board ships; and how seldom our clay merchants explore the ships or even board them. A visit is instructive as well as interesting, and after a thorough examination of an up-to-date ship one leaves with a great feeling of respect or admiration for the captain and officers. To reach the position they hold as certificated navigators they must be scholars, *i.e.*, mathematicians, scientists, astronomers, knowing the earth, the sky, and the seas very thoroughly, besides being business men knowing how to take care of their owners' property and themselves, maintaining discipline on board, while acting with courtesy and diplomacy, and yet to get along in all weathers and conditions, almost, as it were, defying the elements, but generally depending on their own forethought and a kindly Providence to carry them through. After my experience of them I consider the merchant seafaring man as a class to be the bravest of fellows. Typical shipmasters are our Harbour Master, Captain Fred Collins, and his Deputy, Captain Bate, the latter of the square-rigged sailing-ship days.

Still, it was not about the men, but the ships they command, that I am to write.

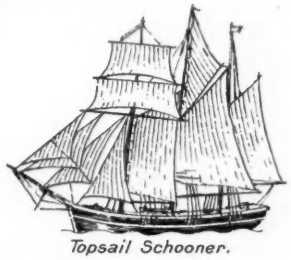
From the small smacks or ketches we have schooners varying in numbers of masts from two up to five, like the *Rebecca Palmer*, the latter now being much more frequent these days, especially since the introduction of the auxiliary motor engines. The topsail schooner still holds its own, though in the more modern ships the tendency is to dispense with the yards—*i.e.*, the cross spars on the mast, which help to make the "square"-rigged ships so majestic; there are the brigantine and the brig. Put a plain mast behind the brig and you have the barque. Take the yards off the second mast and you have the barquentine. You can add to these masts and make four or five masted barques so long as you leave the one plain one aft, the others all being square, or leave two plain ones at least aft and they are barquentines. Make all masts square and you get the "ship"—*i.e.*, full rigged ship. These can go to five or six masts. The yards are very safe for sailing ships, reducing the size of the pieces of sails, but more expensive to handle, as they require many more sailors than the "fore and aft" schooners. The *Rebecca Palmer*, the American five-masted schooner, only needed twelve men and a boy, including captain, three officers, cook, steward and boatswain, leaving just one sailor for each mast! The reason being that the schooner's sails work almost automatically in "staying" and do not have to be "braced"—*i.e.*, the main sails—all she needs to set except in fine weather. A square rigged ship of this size, 4,000 tons, would take at least thirty men, including the same officers. See the saving in wages and food on a month's voyage! The same thing applies in the shape of the vessel. Formerly they were deep and narrow, with high bilges, or almost as deep as wide; and with all the top hamper (masts, yards, gear and sails) they would not stand upright without cargo or ballast on board, hence the need for the "stiffening" clause in the sailing ship charter of years ago, especially such ships as the tea clippers or their kind. Before the ship's ballast could be completely discharged part of the cargo had to be shipped. The *Rebecca Palmer*, like most of the American ships, was twice as broad as she was deep. She could not only stand empty, but actually sailed from Havre to Plymouth (where she loaded part cargo) without any ballast, thus saving the expense of buying, say, up to 1,000 tons of ballast, besides the time wasted in loading, discharging ballast and cleaning the ship, which would have been necessary in a similar-sized old-fashioned square-rigged ship. The loading of these ships with china clay, stone bags and casks, too, needs studying; each ship presenting its own little problems, and the trim requiring the careful attention of the master and agents, who in turn instruct the stevedores. Most ships will carry a full cargo of china clay in bulk or bags, but few will hold a full weight of china clay in casks, especially in the very



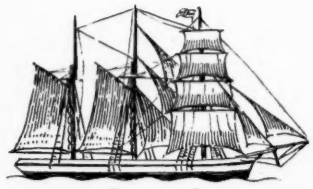
Ship.



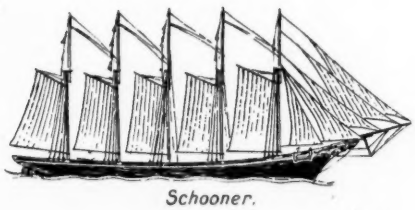
Barque.



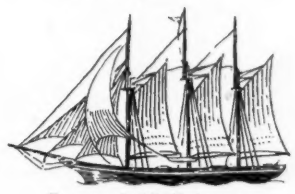
Topsail Schooner.



Barquentine.

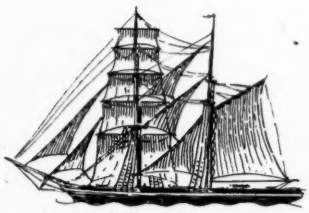


Schooner.

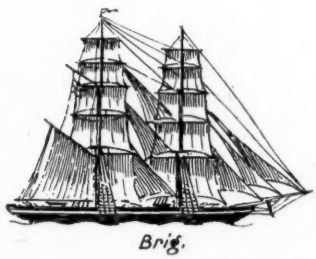


Fore and Aft Schooner.

Smack.



Brigantine.

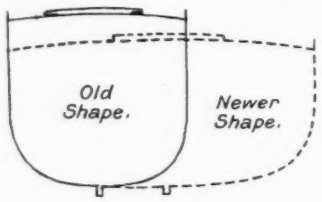


Brig.

Ketch.

dry state in which the clay is shipped to-day. Our American friends object to paying import duty on the water in damp clay, and there is a very decided amount payable as import duty in most countries, even in Canada and India; Holland is one of the few exception (but I must not go into politics). Returning to the stowage of clay cargoes, the weight has to be evenly balanced, mostly in the middle of the ship's main bearings and gradually reducing towards the ends, so that the ship shall keep her buoyancy and not be loggy, as she would be if too much weight were put in the ends. The number of parcels and qualities of clays and separation from the stone also have to be considered. The more modern ships need to have the cargo built up in the ships so that they shall not " roll the masts out " as they would try to do if the heavier cargo, say stone, was trimmed all along the bottom evenly, reminding one of those toys with heavy bottoms which always right themselves when knocked down.

So far we have only referred to sailing ships. With steamers we have something more mechanical, a kind of floating warehouse propelled by very powerful engines. Here, again, we have enough interesting matter to almost surfeit the most fastidious. The same training, or even more so, is needed to command these mechanically propelled ships, but as artificial power is in use a separate set of expert officers is



required and highly trained—*i.e.*, engineers. The ship is driven by a screw practically the same as a screw that you would put into wood with a screw driver except that instead of the worm you have two, three or four blades, all pitched to form a continuous worm, and this worm has to be continually turned at the end of a long rod like an enormous bolt which sticks right through the stern of the ship. Some of these bolts are nearly 200 ft. long and about 12 in. in diameter. This bolt is called a shaft on the steamers. What powerful and beautifully balanced engines are needed to turn it, and at the rate of 80 to 90 revolutions a minute and to keep doing it until it has " screwed " the ship, weighing herself about 4,000 tons and carrying, say, 9,000 tons of clay and her own fuel, all the way to America or wherever she is intended to go. The engines are so placed in the ship to turn this shaft direct, no gearing or belts, just plain direct power straight from cylinders which get their steam direct from the boilers. Place a rod of this kind on the clayworks and see what a huge thing it is, and imagine the sea being so solid as to enable that turning screw to push the ship (a very bulky thing) through it and at a rate of about ten miles an hour. The ships are, of course, designed to get the best results, being sharp both ends, to split at one end and enable the sea to close again at the other without any, or as little as possible, " drag." These ships' engine rooms have lots of intricate auxiliary engines and machinery, pumps, etc., all of which have their own particular interest. To realise the size of these ships it is necessary not only to come on board and be entertained in the cabin by the captain, and not only to look into the holds, but to climb down the long iron ladder reaching about 30 ft. below, and in some cases passing one or two intermediate decks, known as 'tween decks. Take the ordinary number two mainhold, usually the biggest in the ship. This is about an inch or two less than the full width of the ship (55 ft., speaking of 7,000 to 8,000 ton cargo steamers), and perhaps 70/80 ft. long, and, say, 20 ft. deep, holding anything from 2,000 to 2,500 tons of clay. These ships, like the sailing ones, have to be carefully and individually studied, and a very interesting study it is, too. Perhaps, before you leave, by arrangement beforehand, the " Sparks," wireless operator, of these ships could probably entertain you to a Paris concert and explain some of the intricacies of his work. We have seen direction finders on the Belfast " Head " Line steamers. The master of one of these ships was able to correct the positions of some of the Irish signal stations, as shown on the Admiralty or other official records, and perhaps formerly many a captain or navigator has been blamed for showing the wrong position as proved by seeing the point. I think the Tuskar Rock was one. There are lots of different types of steamers too; we have one, a turret ship, in now, the *Teespool*, the section of which is almost like a Bovril bottle.

A visit to Fowey may be likened to one of the advertisements, which " prevents that sinking feeling " !

Since writing the above notes a steamer came in having a " geared " shaft. A German steamer, *Hans Hemsoth*, with turbine engines running at 5,000 revs. a minute, two for forward and one for going astern (reversing), the first gears reducing to 600 and the next to 75, at which rate the single propellor shaft revolved. This steamer also used superheated steam. She was rather unique in another way. She had not the ordinary curved shear, but was built mostly in straight lines—straight sides and deck and bottom with square bilge for the main body of the ship from the stern to the foremast. At that point the deck rose as if bent upwards, and the side plating rose similarly while converging to the stern, giving a very peculiar perspective to the ship, the explanation being that for economy in construction the body frames were all one size and mould—practically square moulds, straight lines—whereas with the curved ship-shape moulds each frame and plate has to be shaped especially for its section of the designer's model. She was too square to have sufficient curve of bilge to allow rolling chocks to be fitted. These are usually placed so as to be protected within the straight lines of the side and bottom within the square. The square bilges gave also more displacement and carrying capacity—several tons on the full length of the ship. The ship, we believe, gave very satisfactory results. She loaded in Fowey a part cargo for the Pacific *via* Panama.

There is at the moment another " peculiar " ship in port, known as a corrugated ship. She has two great corrugations or bulges extending the length of the ship each side, as shown on the enclosed advertisement from *The Shipping World*. I believe she is the ship to which the advertisement refers. The owners, Messrs. Petersen and Co., claim wonderful results, and I understand Sir Wm. Petersen is the designer. The steamer is the *Rio Claro*. This corrugation is said to so affect the ship as to cause a saving in fuel, and to enable her to cross the Atlantic on a consumption of only about 300 tons, whereas most ships of her size require 500 tons at the same speed ! This is believed to be by preventing excessive rolling and directing or controlling the flow of water to the propellor, getting little or no " slip " from the propellor.

On May 6th the Japanese s.s. *Montreal Maru*, a 10,000 ton d.w. steamer, sailed from Fowey with a record large cargo of 8,876 tons 11 cwt. for the U.S.A., drawing 28 ft. 5 in. of water, to which draught she had loaded at the New (N. 8) Jetty without touching the bottom, even when the tide was out. Her dimensions are 405 ft. long, 53 ft. broad and 37 ft. deep. She burns oil fuel. This was her second visit to Fowey, her first a year ago. She had two peculiarities—one of a three-deck type, six hatchways and 18 holds ! *Some* cleaning to be done before starting to load clay and *some* trimming and levelling to get the clay properly stowed away. Every compartment was filled.

Ceramics in Czechoslovakia

THE manufacture of ornamental bricks and tiles, mosaics, etc., has developed from a purely manual process to one carried on by means of the most up-to-date machinery. Such machinery as well as plant and equipment for the ceramics trade generally is made in the country.

The decorative ceramics produced in Czechoslovakia for the building trade have found great favour, not only in this country itself, but also abroad, as have also the faience tiles, for stoves, and productions of popular art turned out in various parts of the country, but more particularly in Slovakia. Vases, statuettes, and ornaments of all kinds are turned out by the Graniton Co., and others.

Last year some 20 million crowns worth of tiles for walls, tesselated pavements, etc., were exported, some five millions worth going to the Argentine Republic.

Determination of the Value of China Clay for Finishing Purposes

From "Chemistry and Practice of Finishing," by Percy Bean

CHINA CLAY of the best quality should always be used for finishing purposes. A standard sample should be kept for comparison with samples submitted for sale. This sample should be kept in a well-stoppered bottle. China Clay should be tested for grit, "feel," colour, lime, iron, organic matter, and added blue.

Test for Grit

Grit in China Clay is obviously objectionable for finishing purposes. The clay may be tested thoroughly for the presence of this objectionable impurity by placing a little of the sample between the teeth, when any slight grittiness is at once apparent. A better test, and one that can be made comparative, is carried out as follows:—

Equal portions of the clays under examination are "rubbed up" into thin pastes with equal quantities of water in separate watch glasses. A small portion of each sample is then placed on a smooth piece of glass (the glass slides used for the microscopic examinations of starch are the most suitable) and a thin cover glass placed over it. The cover glass is then rubbed with gentle pressure on the paste, when the slightest grittiness is at once apparent. Where several samples are being examined, one may be readily compared with another. A comparison should be made with the standard sample. If the clay be of low grade, the grit would be perceptible to the fingers, when it is "rubbed up" with water in a watch glass.

The "Feel" of China Clay

The "feel" of China Clay is an important point to consider where this substance is intended for finishing purposes. A sample may be free from grit and yet not possess the unctuous "feel" peculiar to clay of good quality. At the same time it is necessary to use careful judgment in deciding that one particular clay is possessed of a more unctuous "feel" than another, as very often the difference in this special "feel" is entirely due to the higher percentage of water contained in one of them. That this is the case may be really seen if a sample of China Clay be dried for some hours, and afterwards compared with a portion of the undried original sample. The dried portion will have lost a great amount of the "feel," but it may not therefore have lost any of its value for finishing purposes.

If any value is to be placed upon the test for "feel" the experiment must be conducted with China Clay which has been dried, and afterwards made into a thin paste with water, thus negativing the effect of the extra moisture one clay may contain more than another. For this test therefore, equal quantities of the standard sample, and the sample under examination, should be taken after drying, and placed on smooth glass plates (large watch glasses) and equal quantities of water, sufficient to make them into thin pastes, added. Each sample should then be rubbed with the finger, and the "feel" noted. Some clays quickly absorb water, producing a creamy paste, whilst others separate rapidly from the water with which they are mixed.

Colour of China Clay

The colour of China Clay is a most important consideration in selecting this substance for finishing purposes. The sample should be compared with the standard sample by placing a small quantity of each, side by side, on a sheet of blue paper. When pressed flat the difference in colour is immediately seen, especially at the point of contact. The test should be carried further by mixing samples of the clay with water on a white plate, and comparing the colour after they have absorbed water. The yellow tint in low grade clays may be due either to iron or to organic matter. As a rule it is due to iron. This objectionable colour can be covered by blueing, but when the blue fades the original colour of the clay will appear.

Clays of bad natural colour are frequently tinted with blue to give the desired whiteness. Clays so treated should be tested as follows:—

A portion of the clay is divided equally into three parts, and each part is placed on a watch glass, and made into a paste with water.

A few drops of strong ammonia should be added to one of the pastes. The second paste is treated with a few drops of bleaching powder solution, whilst the third is treated with a few drops of strong hydrochloric acid. If, after these tests, the pastes remain white the clay may be passed, but if it be rendered brown, or yellow, it should be rejected. The objection to tinted clays, over and above the fact that they are not of the best quality, is that the blue colour may disappear when the cloth is exposed to light, and the dark and objectionable natural colour of the clay will then reappear.

The reagents, ammonia, bleaching powder solution, and hydrochloric acid, are used for the purpose of detecting the presence of basic and substantive aniline blue, and ultramarine blue. Basic aniline blues are destroyed by the addition of ammonia. Bleaching powder solution on the other hand, discharges the substantive colour as well as the basic colour. Hydrochloric acid destroys the effect of ultramarine blue by decomposing this compound. As a matter of fact, basic aniline blue is almost invariably used for tinting China Clay because it gives a brighter appearance to the clay than a substantive colour, and it is easier to use than ultramarine blue. A China Clay of good, natural colour should be effected slightly only by either of the above tests.

It will be as well to warn finishers that whiteness in clay is not always an index of its suitability for finishing purposes. There are some very white clays which are exceedingly gritty. It is necessary, therefore, to judge the value of the clay for finishing purposes by the application of tests other than that for colour only.

Test for Lime

China Clay should be free from chalk or limestone (carbonate of calcium). The presence of this substance is detected by adding a small quantity of hydrochloric acid to the sample. If carbonate of calcium be present, effervescence occurs, and the calcium passes into solution as $CaCl^2$. The presence of calcium may be further confirmed by testing this solution in the usual way.

Test for Iron

Iron is sometimes found in China Clay in sufficient quantity to damage cloth by developing iron stains. The following test should therefore be applied:—

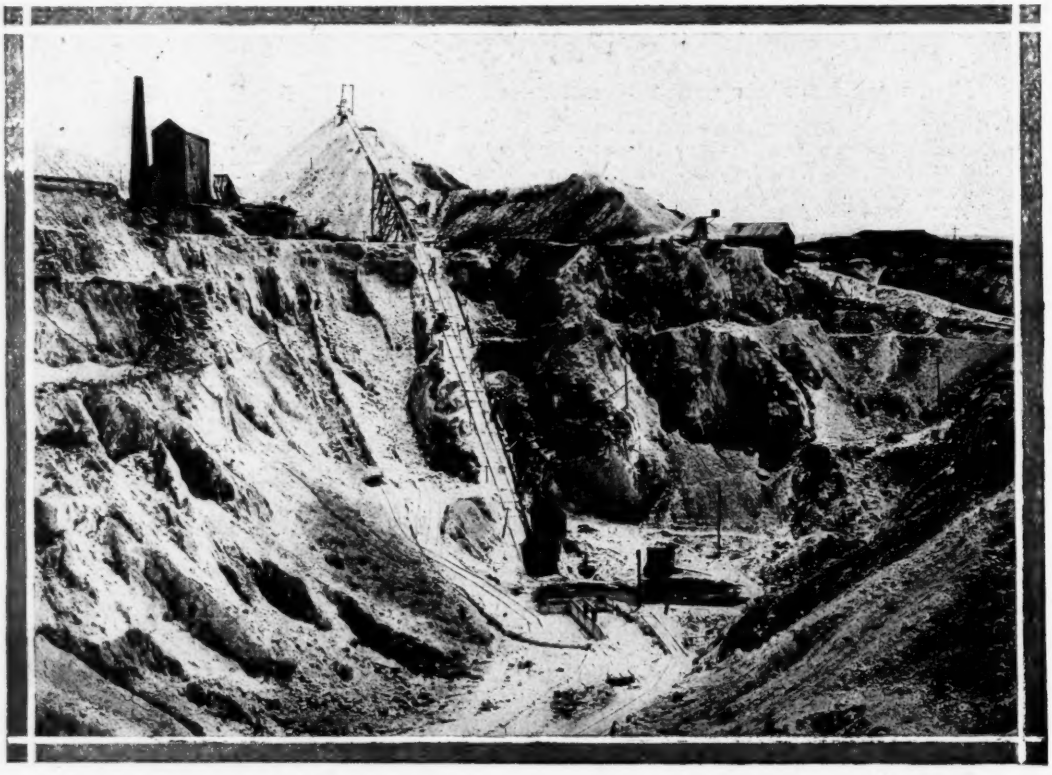
Equal quantities of the standard clay and the sample should be mixed in separate watch glasses with sufficient water to form thin pastes. Two drops of pure concentrated hydrochloric acid should be added to each sample and well stirred into the mixtures. They should then be allowed to stand for five minutes, and at the end of that time, exactly two drops of a very dilute solution of ferrocyanide of potassium should be added to each. If iron be present a blue colour will develop, varying in intensity according to the amount of iron. Most samples of China Clay will give a faint shade of blue with this test, but in some cases the colour is very deep.

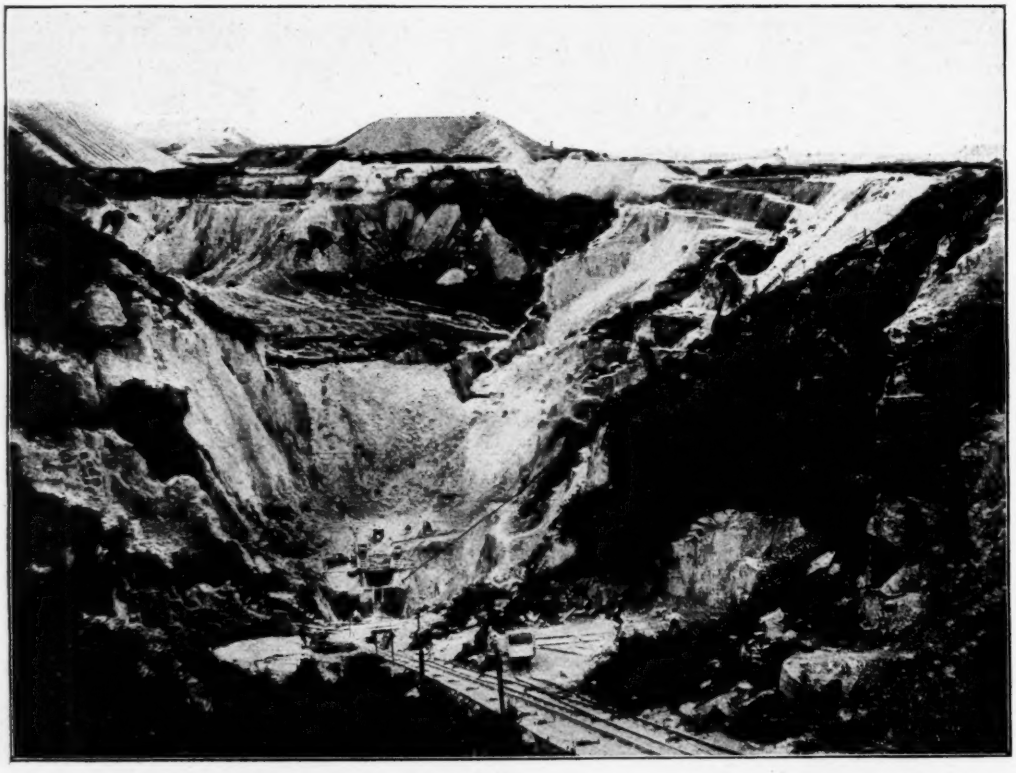
Another test, which is sometimes useful, is to mix equal quantities of the standard sample and of the clay to be examined with equal quantities of water, and allow them to stand for several days. In clay contaminated with iron a brownish shade is produced by this exposure. Such a sample should never be used in finishing.

Mineral Acids in China Clay

Mineral acids and occasionally oxalic acid, are sometimes used for improving the colour of China Clay. Providing every trace of acid be removed by washing there is no objection to the use of clay so treated. At the same time the greatest care should be exercised in the selection of China Clay for finishing purposes because free mineral acid would be most objectionable in its effects. The presence of free mineral acid may be determined by shaking up a portion of the clay with water, filtering off, and afterwards treating the filtrate with one or two drops of a solution of a methyl orange. If a free mineral acid or oxalic acid be present the filtrate will be coloured pink.

(*Continued on page* 14)





Two of the Clay Pits of ENGLISH CHINA CLAYS, Ltd.

(Continued from page 11)

Use of China Clay in Finishing

A good clay, especially if intended for heavy fillings, should always be used in finishing. A better looking and brighter cloth is obtained by using a high-class clay, and there is less " dusting off " when the cloth is handled.

China Clay, as sold to finishers, may vary very greatly in the amount of water required to make a heavy mixing. Very often the clay which requires the least amount of water makes the thinnest mixing, and where heavy fillings are required this is an advantage. It is important that the finisher should use similar clays where he requires identical results. Otherwise he may have considerable variations in his cloth from time to time. If a recipe for a mixing is given and no standard for the clay is laid down, it is possible to get great variations in the results. On this account care must be exercised by the finisher. The clay used by the authors for the mixings described in the section on practical finishing, was the " special super " clay of the West of England China Stone and Clay Co., and the quantities of the various ingedients are based upon the use of this. The authors do not suggest that there are no other suitable clays on the market, but in laying down a mixing, it is necessary to have some standard as a basis, otherwise unexpected results may be obtained.

China Clay forms an opaque smooth mass when mixed and boiled with starch and water. It has great covering properties, and when used in mixings for " backfilling " or starching the lower qualities of whites and prints, it gives a better and fuller appearance than could be obtained from starch alone.

China Clay should be boiled in water for periods ranging from one to four hours, according to the class of mixing in course of preparation. In light and medium fillings, where the quantity of water used is fairly large as compared with the weight of China Clay, it will not be necessary to boil as long, in order to effect the separation of the clay, as it is for heavy fillings, where these conditions are reversed. The sole object of boiling China Clay is to bring about a separation of the particles of clay as thoroughly as possible. Some finishers do not boil China Clay before mixing it with the other ingredients of the filling, but simply agitate it with cold water in a clay pan. This is not a good method, unless dried and powdered China Clay be used, as the particles of the clay cannot be so finely divided and it will not produce so smooth a filling as clay which has been well boiled in water. Moreover there is a greater tendency for the cloth to be " dusty " if the boiling process be not carried out.

Although boiling is stated to be the best method for treating China Clay, before its admixture with the other ingredients of the filling, the authors are firmly convinced that under different conditions it could be improve upon. It is otherwise with starch. This substance has to be boiled, in order to break up the starch granules into particles as fine as possible, by gelatinisation. In China Clay, however, there are no granules to gelatinise, the particles of the clay being simply held together by the moisture contained in the clay. That this is the case is shown by drying it. In the dried state it will be found to be much more easily reduced to a fine powder than it is in the undried state. It will also be found that the powdered clay will mix much more readily with water than the clay in its unbroken state. It stands to reason, therefore, that if dry powdered clay were used instead of damp, lumpy clay, there would be no necessity for prolonged boiling with water. This has been proved conclusively by the writer, especially for " sizing " purposes.

It will, therefore, be clearly seen, that where large quantities of China Clay are used, a considerable saving of time, and also of steam would be effected, if the clay could be bought dried and ground instead of in a lumpy condition. In the latter case steam is required for the purpose of boiling the clay, which has to be cooled sufficiently before the starchy matter can be added.

It would not be practicable to set up suitable plant for powdering China Clay in every bleaching and finishing works, but the matter is well worth the consideration of every finisher. Recently, powdered China Clay has been placed upon the market by several firms, amongst whom are the English China Clays, Ltd. The authors are certain that finishers would soon find the advantages of using powdered China Clay if they had to give it a trial.

Method of Mixing China Clay

In using China Clay for finishing purposes a standard mixing is prepared. This usually contains six pounds of clay to each gallon of water, a proportion which is found to mix easily. The mixture of clay and water is drawn from the China Clay pan, or mill, as required. Before it is mixed with the starch, in the " Starch tub " it is passed through a fine sieve, in order to remove grit or lumps of unbroken clay. The clay should be well agitated with the starch before the mixture is boiled, in order to get the particles of clay intimately mixed with the starch granules. This is necessary if the best results are to be obtained. Badly mixed clay and starch igve a " dusty " finish, and the " cover " is poor.

Analysis of China Clay by Washing

For technical and economic purposes the formation of ceramic pastes supposes an accurate knowledge of the materials employed. Determination of the chemical composition is not sufficient, the percentages of aluminium silicate, quartz and felspar must also be ascertained, as also the constancy of the physical constitution, by means of washing or livigation. This washing, or granulometric analysis, enables mechanical division of the clay into classes of grains, according to dimensions, which sink in water with a degree of rapidity depending upon the size of the grain. This assures separation of the pure clay from the non-plastic elements, such as sand, calcium carbonate, bits of stone, etc. Washing is the only method to perfectly remove these elements and give results of great precision, from this point of view. Such a result cannot be attained with the methods of Elsner, for example, on account of the excessively small difference in the specific gravity of the various constituents (vide Dingler's *Pol. Journal*, 175, p. 82; *Keramische Rundschau*, xxxi., No. 40, p. 360).

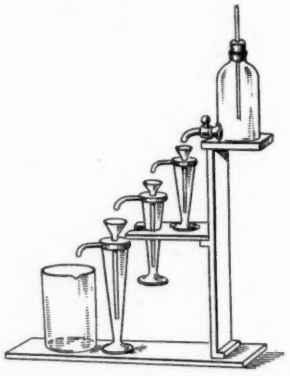


FIG. 1

The Schulze apparatus answers in most cases. It consists, in principle, of a conical glass receptacle with a brass ring and outlet nozzle fixed on the wide upper edge. A sieve with 800 meshes per sq. centimetre separates the coarse grains. For practical work there are several of these glasses (Fig. 1). In the Schulze apparatus, modified by Bollenbach (*Keram. Rund.*), the glass vessel is higher and more slender. Its top is cylindric, to give uniform velocity to the water in the space reserved for washing and prevent adhesion of the particles to the inclined side. A stopper, with three openings, carries a short bent nozzle, a graduated tube with a funnel to introduce the clay to be washed and a tube running to the bottom of the glass through which the water flows with greater or less velocity. The Nöbel apparatus (Fig. 2) is a modification of that of Schulze, as shown in Fig. 1.

The Schöne apparatus has a real advantage from the point of view of uniform flow of water in the washing glasses. It consists (Fig. 3) of a conical glass (the point at the base), with a cylindric section at the top, 10 centimetres deep and 50 millimetres in diameter. A smaller funnel-shaped glass is used to put the clay inside. This glass also has a cylindric top, 25 millimetres in diameter, and is placed near the first glass with which it is connected by a glass and rubber tube. Water runs from a tank, 1·50 metre above, into the little

glass, the flow being regulated by a tap. After passing through the two glasses the water enters a tube styled " piezometer " (Fig. 3). This tube is graduated in millimetres to measure the pressure of water, and consequently the " speed of washing," that is to say the velocity with which the grains of clay and other minerals are raised, per second, in the cylindric part of the large glass.

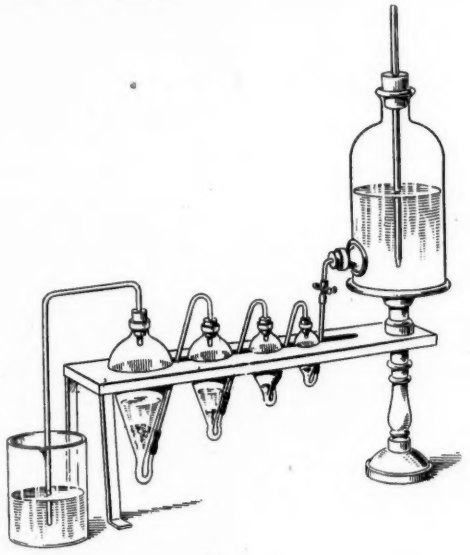


FIG. 2.

Now, as all the grains, clay and mineral, have about the same specific gravity for similar dimensions, separation, in the chemical and mineralogical meaning, is impossible by this method, which must, consequently, be supplemented by chemical analysis of the various separate constituents, by way of control or verification.

With the Schöne apparatus different rates of speed in washing can be employed, regulated by a special tap and recorded by the column of water in the piezometric tube, all with great ease. The following is an example with different rates of speed in washing:—

Grains.	Speed in in millimetres per second.	Dimensions of Grains. Millimetres.
Argillaceous Matter or Fine Clay	0·18	0—0·01
Fine Sand	1·5	0·02—0·04
Medium Sand	3	0·04—0·2
Coarse Sand and Residue	Above 3	Above 0·2

As the grains of clay or argillaceous paste can be classed with this apparatus, according to dimensions, the most favourable granulometric composition can be ascertained once for all. If we consider the phenomenon of drying and shrinkage, we can see that it is not a matter of indifference whether a clay contains fine grains of clay, quartz, sand and felspar on one occasion and coarser grains on another. Thus irregularities in composition, met with when an effective method of analysis is not followed, are avoided, as also those in drying and shrinkage, when accurate levigation is made. The importance of this analysis is so much greater and useful because the deposit of China Clay in the beds is naturally more irregular and it contains hardly perceptible impurities. Finally, levigation or granulometric analysis renders great services in cases when a new pit is to be opened out or a local clay used in place of a foreign. In both these cases there is a considerable amount of preliminary work and experimenting, and for success a washing analysis is necessary. Merely to mention one example, the Germans succeeded by a closer study of their soils in considerably reducing the imports of foreign special clays which they replaced by native products, the employment of which they had hitherto regarded as out of the question.—(*Revue des Matériaux de Construction*, February, 1924.)

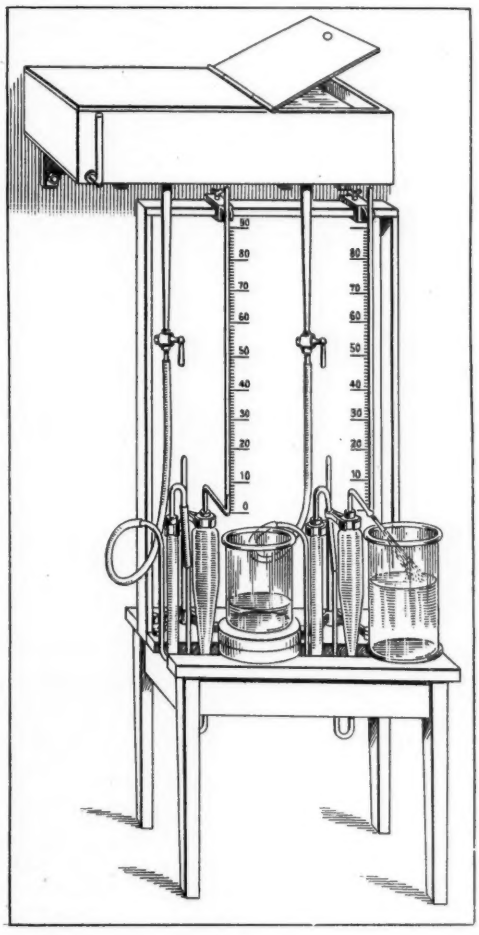


FIG. 3.

Practical Studies for Paper Manufacturers

THE above volume, published by Chas. Griffin and Co., of Exeter Street, Strand, W.C.2, at 21s. 9d., and written by Mr. Sheldon, Leicester, lecturer on paper making and testing at the Battersea Polytechnic, London, meets the needs of students seeking technical knowledge of the many branches of a far-reaching industry.

The writer's long experience as lecturer on paper making and paper testing at the Battersea Polytechnic, has suggested to him that there is room for a practical handbook of wide scope which should be fully introductory and partly supplementary to the highly specialised technical treatises already available. Such a book, in so far as it realises its intention, will equip students with a general knowledge of principles and practice, and will give them guidance and encouragement in their passage to more advanced work.

There is no need to dilate on the importance of the matter discussed in the following pages. The whole world works on paper, and without it commerce, industry and literature would be in jeopardy. The paper industry has ramifications of a range and variety bordering upon romance, and present-day requirements necessitate a thorough knowledge of the purposes for which paper is manufactured. The intelligent artisan requires information upon the common fibres used in paper making and the treatment of the materials he has to handle; he should feel the fascination of the chemical processes involved and should appreciate the wonderful modern machinery now available for all sorts of purposes. He needs training in respect of colour and of the almost magical results which may be brought about by thorough study of natural and artificial colouring materials.

China Clay Notes and News

China Clay Industrial Council

RECENTLY there has been a desire expressed for the resuscitation of the Industrial Council of the China Clay industry, which was established in 1918 for the mutual settlement of matters affecting the relations of the China Clay workers and their employers. Largely on account of there being no outstanding matters to settle, the Council has for some time ceased to function. A meeting representative of the workers' and employers' sides was held on May 6, when it was decided to refer the re-establishment of the Council to the consideration of the members of the Employers' Federation at a meeting called for the purpose.

The China Clay Industrial Council

Back row—reading from left to right—Mr. I. M. STOCKER, J.P., COL. LOVERING, Messrs. H. KERN, J. HOOPER, J. LOBB and GOUDGE. Middle row—Messrs. E. J. HANCOCK, S. BENSON (Secretary to the Council and also the Associated China Clays), J. PERRY, R. MARTIN, TAMBLYN and TRUSCOTT. Front row—Messrs. HART NICHOLLS, SKIDGEMOOR, R. H. TABB, JOS. HARRIS, J. W. HIGMAN, J.P., W. SESSIONS, ROWE and W. STONE.

Brittany China Clay Co.

The prospects of the above company do not appear to be all that could be desired, from the shareholders' point of view. The directors report that in the present state of exchanges there is no immediate prospect of dealing with the company's property.

Pentewan Docks

We have been informed that the negotiations for the Pentewan Docks and Railway have been satisfactorily concluded, and we understand that the new firm, the Pentewan Railway Port and Trading Co., Ltd., are determined to explore every avenue of trade possible to restore the port's pre-war prosperity, including the China Clay industry which supplied so much shipping formerly. The re-opening of the line will be awaited with great interest.

Facts About Fowey

In his annual report submitted to the May meeting of Fowey Town Council, Dr. R. T. Cann, Medical Officer of Health, returns the population at 1,982, and the acreage at 2,032. With the exception of two cases of tuberculosis there was a total absence of all other notifiable diseases.

There had been an increase in a mild type of bronchitis amongst workers in the holds of ships carrying China Clay due to some change in the drying process at the works. Hitherto China Clay dust had been harmless. (There is no general change in the process of drying China Clay. The trouble is probably due to China Clay now being dried more, in deference to the requirements of paper-makers who look for a much lower percentage of moisture in the clay than formerly. Consequently there would be more dust.)

In a reference to housing conditions at Fowey, the Medical Officer states that only one house was erected in 1923. None of existing houses were found to be unfit for human habitation, but many of them did not quite come up to modern requirements. The absence of new houses was due to the need for an adequate water supply. Very little could be done to improve housing conditions until there were more houses. There was surprisingly little overcrowding. The greatest inconvenience was felt by the jetty China Clay workers who as things were had to live outside the area and travel a distance to their work.

Since the Medical Officer's report was written the Council's water schemes for the town and jetties have been completed, and plans for the erection of nineteen houses have been passed. They are being erected by private individuals under the Government subsidy scheme of £75 per house. A further comment made about Fowey houses by the Medical Officer was that many of them are now owned by the working classes.

The White Wealth of the West

ONE of the best descriptions of the China Clay producing areas in Cornwall and Devon is that contained in "A Handbook to the Collection of Kaolin, China Clay and China Stone in the Museum of Practical Geology, Jermyn Street, London, S.W.," by J. Allen Howe, B.Sc., F.G.S., the Curator at that fascinating museum. He says :—

"The China Clay of Cornwall and Devon occurs as an alteration product of the granite which rises up from the surrounding "killas," a slaty rock which has been altered by contact with the granite forming isolated hilly districts. Four are situated in Cornwall; they build the high ground about, (1) Lands End, (2) Penryn, (3) St. Austell, (4) Bodmin Moor, and there are several subordinate patches as at Breage, Redruth, St. Dennis and elsewhere. A fifth mass of granite forms the Dartmoor highlands of Devonshire.

Each of these granite masses shows local indications of kaolinization, but the most important centres of the kaolin industry are situated in the St. Austell mass, on Bodmin Moor and near the south-western margin of Dartmoor.

The most elevated mass is Dartmoor with its rugged weatherd tors reaching 2,000 ft. above sea-level; Bodmin Moor comes next, then the St. Austell mass with Hensbarrow, 1,000 ft.; the Penryn and Land's End masses are lower. Each rises prominently from the surrounding sedimentary rocks, and takes on rounded gentle outlines except here and there where the tors stand towering above the general level.

The highest ground and some of the broad hollows are uncultivated heath-clad moors, lower down are small grass farms. Some of the clay pits, for example, Stannon Marsh on Bodmin Moor, are far removed from the villages, but in the central and western portions of the St. Austell granite villages are frequent and the district presents an appearance of considerable activity.

Here on every hand the country-side is marked by great hills of sand waste from the pits, dazzling white in the sunshine, vast white open pits accompany them, while on the hilly roads creaking wagons of clay drawn by teams of three or four horses are continually passing up and down.

The workers' houses, substantial, granite built, each with its bit of land and well-kept garden, add an air of comfort to that of prosperity. The workman, whitened with the clay, may be met cycling home or quite as often driving his own pony or donkey, harnessed to a vehicle noteworthy for the economy of material employed in its construction, consisting as it does merely of shafts, wheels and an axle bar on which the driver sits in apparent ease. The clay miners are a healthy well set-up lot of men and accidents are rare in the clay pits.

A noticeable feature of the China Clay districts is the milky whiteness of most of the streams flowing from the neighbourhood of the pits. In certain cases elaborate precautions have had to be taken to prevent the contamination of the streams on account of fishing rights; thus at Lee Moor a large shallow lake has been formed to intercept the waste clay water, and at Stannon Marsh a large dam has been built to achieve the same end.

He goes on to tell us about William Cookworthy and the discovery of China Clay.

The China Clay industry of the West of England has now been in existence about a hundred and fifty years. Prior to this the clay had been worked in a small way for pottery at Breage and St. Stephen. Its discovery and the early development of the trade were due to the activity of William Cookworthy, a native of Kingsbridge in Devonshire.

He was born in 1705, and his father, dying while he was yet a lad, left his mother and a fair-sized family in straitened circumstances. At an early age William walked from home to London in search of employment; this he found with one Bevans, a chemist and druggist, to whom he became apprenticed. Subsequently he was taken into partnership with his employer, who started a business in Plymouth under the style of Bevans and Cookworthy. Always an active member of the Society of Friends, about 1736 he resigned business in favour of the ministry; but later, in 1745, though still retaining his interest in the Friends' work, he returned to his old trade at Plymouth in partnership with his brother Philip. The latter attended to the business at Plymouth while William Cookworthy travelled for the firm and found time for experiments and the search for minerals. In his search he appears to have had some faith in the help of the divining or "Dowsing rod."

Cookworthy, having read D'Entrecolle's account of the kaolin and petuntse of China, became interested in this subject, and when in 1745 an American showed him some samples of China Clay and China stone, said to be from Virginia, also some ware made from these materials, he set about diligently to search for similar materials in Cornwall. About the year 1755 he recognised the materials near Breage, "a white saponaceous clay, and close by it a species of granite or moorstone, white with greenish spots." "I first discovered it," says Cookworthy, "in the parish of Germo, in a hill called Tregonnin Hill. The stone is of compounded small pellucid gravel and a whitish matter, which indeed is kaolin petrified. . . . If the stone is taken a fathom or two from the surface, where the rock is quite solid, it is stained with abundance of greenish spots, which are very apparent when it is wetted. This is a circumstance noted by the Jesuits, who observe that the stones which have the most of this quality are the most proper for the preparation of the glaze; and I believe this remark is just, as I know that they are the most easily vitrifiable, and that a vein of this kind in Tregonnin Hill is so much so that it makes an excellent glaze without the addition of vitrescent ingredients. If a small crucible is filled up with this stone or a piece of it put in it and exposed to the most violent fire of a good wind furnace for an hour the stone will be melted to a beautiful mass; all its impurities will be discharged, one part of it will be almost of a liquid transparency, and the other appear in spots as white as snow. The former is the gravel, the other the kaolin reduced by fire to purity."

From the time of the discovery onwards Cookworthy pushed on with his investigations into the nature of the material and its employment for the manufacture of porcelain. In this he was assisted by Lord Camelford, and in 1768 they jointly obtained a patent for the exclusive use of these materials in the manufacture of porcelain and pottery. In 1774 this patent was sold to Richard Champion, a potter of Bristol.

Champion seems to have been not very successful, but in 1775 he petitioned Parliament for an extension of the patent for a further fourteen years, till 1796.

Josiah Wedgwood, Turner, and other potters of Staffordshire, opposed this Bill on the grounds that the patent would be injurious to their trade. They obtained (with the aid of Earl Gower) an alteration which "while it confirmed Mr. Champion the sole and exclusive application of the Cornish clay and stone for the manufacture of transparent ware, however it might be named—porcelain or any other designation—it allowed the potters generally the free use of the stone in the opaque glazes, and of the clay in opaque pottery.

In 1777 the patent was sold to a syndicate of Staffordshire potters, who maintained the monopoly in China Clay and China stone (Cornish stone) until it expired in 1796.

The export of China Clay and stone from Cornwall—Breage and St. Stephen districts—commenced soon after Cookworthy's discovery, for as early as 1759 we find that small quantities of these materials were being used in Staffordshire potteries.

William Cookworthy died in 1780.

Czechoslovakia China Clay

The total output of prepared kaolin in Czechoslovakia is about 250,000 tons per annum. The beds of this material at Horni Briza, near Pilzen in Bohemia are, in places, over 180 ft. in thickness and present an interesting geological study. They are indeed the largest of their kind in Europe. Plastic clay of a high fire-resisting quality is also found in large quantities in Czechoslovakia, and this, too, is not only employed for purposes of the home industry but also exported as raw material.

The manufacture of pottery in Bohemia dates from the thirteenth century, and during the Middle Ages Bohemian products had already acquired a wide reputation. The industry is concentrated largely in the Most and Duchcov districts in the north, round Pilzen and Rakovnik, and in the vicinity of Znojmo in South Bohemia. In Moravia pottery is produced in the neighbourhood of Boskovice and Kunstat; in, Slovakia (where much of a typical local character is turned out) extensive deposits of suitable clay—which have not yet been fully exploited—have given rise to a brisk industry.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Fowey Shipping—April, 1924

Arrived.	Name.	Sailed.	Destination.
April 1, S.S.	*Ualam*	April 5,	Antwerp
April 2, S.S.	*Mistley*	April 5,	Ridham
April 2, S.S.	*River Usk*	April 7,	Antwerp
April 2, S.S.	*Taycraig*	April 5,	Rouen
April 2, S.S.	*Pembrey*	April 5,	Larnes
April 2, S.S.	*Raylight*	April 8,	Weston Point
April 2, S.S.	*Falmouth Castle*	April 5,	Weston Point
April 3, S.S.	*Stanley Force*	April 5,	Leith
April 3, S.S.	*Pansy*	April 10,	Preston
April 3, S.S.	*Allanwater*	April 9,	Liverpool
April 3, S.S.	*Condor*	April 10,	Antwerp
April 3,	*Ovenbeg*	April 28,	Leith
April 3, M.S.	*Schelde*	April 10,	Terneuzen
April 4, S.S.	*Rossmore*	April 12,	Rouen
April 4, S.S.	*Primrose*	April 14,	Rouen
April 4, S.S.	*Chersones*	April 10,	Brussels
April 4, S.S.	*Mellanear*	April 14,	Weston Point
April 4, S.S.	*Ralum*	April 15,	Terneuzen
April 4,	*Raymond*	April 17,	Newcastle
April 5, S.S.	*Dempster*	April 17,	Brussels
April 5, S.S.	*China Maru*	April 19,	Philadelphia
April 5, S.S.	*Farfield*	April 11,	Garston
April 6, S.S.	*Clumberhall*	April 17,	Philadelphia
April 6,	*Normande*	April 7,	Charlestown
April 6,	*Englishman*	April 18,	Runcorn
April 6, S.S.	*Moss Rose*	April 7,	Preston
April 6, S.S.	*Jolly Norman*	April 14,	Gravesend
April 8, S.S.	*Sojourner*	April 12,	Rouen
April 8,	*Waterwitch*		*
April 8, S.S.	*Gertie*	April 16,	Fleetwood
April 9, S.S.	*Hayle*	April 12,	Preston
April 9,	*Flying Foam*	May 3,	Runcorn
April 10, S.S.	*Hans Hemsoth*	April 23,	Portland, Ore
April 10,	*Rise*	April 28,	Leith
April 10, S.S.	*Emlynmor*	April 15,	Methil
April 10, S.S.	*Ronda*	April 28,	Portland, Me
April 11, S.S.	*Cromwell*	April 15,	Weston Point
April 11,	*Alice Williams*	May 3,	Runcorn
April 11,	*Margrethe*	April 22,	Harburg
April 11,	*Weser*		*
April 14, S.S.	*Berkelstroom*	April 25,	Amsterdam
April 14, S.S.	*Falmouth Castle*	April 17,	Runcorn
April 14, S.S.	*Ravenspoint*	April 24,	Genoa
April 14, S.S.	*Uranus*	April 25,	Skien
April 15, S.S.	*Prutan*	April 23,	Harburg
April 15, S.S.	*Seaforth*	April 18,	Par
April 16,	*Nanna*		*
April 18, S.S.	*Mersey*	April 24,	Grimsby
April 18, S.S.	*St. Senans*	April 28,	Rouen
April 18, S.S.	*Ualan*	April 25,	Bilbao
April 19, S.S.	*Fairland*	April 28,	Liverpool
April 20, S.S.	*Montreal Maru*	May 6,	Boston & Portland, Me
April 20, S.S.	*Harald Casper*	May 3,	Boston, Mass
April 20, S.S.	*Pengam*	April 29,	Seville
April 20, S.S.	*Balmyle*	April 24,	Charlestown
April 21, M.V.	*Ilmatar*	April 28,	Gothenburg
April 21, S.S.	*Calluna*	May 1,	Brussels
April 22, S.S.	*Oak*	April 30,	Liverpool
April 22, S.S.	*Edern*	April 29,	Ridham
April 23, S.S.	*Elidir*	May 1,	Preston
April 23, S.S.	*Orenie*	May 1,	Rouen
April 23, S.S.	*Fernside*	May 1,	Newcastle
April 24, S.S.	*Annie*	May 3,	Runcorn
April 25,	*Fanny Crossfield*	May 2,	Par
April 25, S.S.	*Horsham*	May 2,	Rotterdam
April 25, S.S.	*Rio Claro*		*
April 26, S.S.	*Belgium Maru*		*
April 26, S.S.	*Mercutio*	May 1,	Liverpool
April 27, S.S.	*Moss Rose*	May 1,	Lydney
April 29, S.S.	*Condor*	May 5,	Antwerp
April 30, S.S.	*Falmouth Castle*	May 5,	Weston Point

Par Harbour Shipping—April, 1924

Arrivals

Date.	Vessel.	From.
April 1, S.S.	*Treleigh*	Portreath
April 1, S.V.	*Snowflake*	Runcorn
April 2, S.V.	*Lord Devon*	Runcorn
April 5, S.V.	*Rhoda Mary*	Runcorn
April 6, M.V.	*Hannah*	Falmouth
April 7, S.V.	*Greenhithe*	Poole
April 7, S.V.	*Rose*	Cardiff
April 8, S.S.	*Torpoint*	Bridport
April 8, S.V.	*Alzina*	Plymouth
April 9, M.V.	*Crest*	Plymouth
April 9, M.V.	*Anni*	Penryn
April 9, S.V.	*Esperance*	Trige
April 10, S.V.	*Hosianna*	Plymouth
April 11, S.S.	*Katherine*	Plymouth
April 11,	*The Sirdir*	Plymouth
April 15, S.V.	*Iris*	Brest
April 18, S.S.	*Seaforth*	Newport
April 19, M.V.	*Maryse*	Cardiff
April 19, S.V.	*Henrietta*	Mevagissey
April 20, M.V.	*Katie*	Rochester
April 20, S.S.	*Coombe Dingle*	Jersey
April 21, S.S.	*Magri*	Bridgwater
April 23, S.S.	*Treleigh*	Portreath
April 29, S.S.	*Norri*	Hull
April 29, M.V.	*Hetty*	Charlestown
April 30, S.S.	*Castlerock*	Penryn

Sailings

Date.	Vessel.	Destination.
April 1, M.V.	*Schwan*	Leith
April 1, M.V.	*May Blossom*	Looe
April 3, S.V.	*Ovenbeg*	Fowey
April 4, S.V.	*Elsa*	Weston Point
April 4, S.S.	*Treleigh*	Runcorn
April 8, S.V.	*Snowflake*	Weston Point
April 9, S.S.	*Torpoint*	Penarth
April 15, M.V.	*Hanna*	Poole
April 15,	*Greenhithe*	Shumers
April 15, S.V.	*Alzina*	Plymouth
April 15,	*The Sirdir*	Pentewan
April 16, S.V.	*Crest*	Preston
April 16, M.V.	*Anni*	Kircaldy
April 16, S.S.	*Katherine*	Plymouth
April 17,	*Esperance*	Boulogne
April 19, S.V.	*Lord Devon*	Runcorn
April 19, S.V.	*Rhoda Mary*	Runcorn
April 19, S.V.	*Iris*	Boulogne
April 23, S.S.	*Seaforth*	Ghent
April 24, S.S.	*Coombe Dingle*	Bristol
April 24, S.S.	*Magrix*	Rochester
April 29,	*Treleigh*	Preston

Charlestown Shipping—April 1924

Arrivals

Date.	Vessel.	From.
April 2	*Conis Crag*	St. Ives
April 3	*Shellie*	Bantry
April 4	*Gongon*	Cardiff
April 5	*Venturer*	Plymouth
April 7	*Normande*	Portrieus
April 7	*Lady Daphne*	Truro
April 8	*Naiad*	Mevagissey
April 9	*Saltom*	Jersey
April 10	*Scone*	Torquay
April 15	*J. H. Barrow*	Looe
April 16	*Portadown*	Plymouth
April 17	*Saint Aiden*	Southampton
April 17	*Nancie Thomas*	Barry
April 17	*Hetty*	Rochester
April 24	*Balmyle*	Fowey

Sailings

Date.	Vessel.	Destination.
April 4	*Conis Crag*	Runcorn
April 4	*Shellie*	Fleetwood
April 5	*Martin Nixon*	Tayport
April 5	*Mary Barrow*	Rochester
April 6	*Goldfield*	London
April 10	*Lady Daphne*	Rochester
April 15	*Scone*	London
April 10	*Saltom*	Barrow
April 17	*Naiad*	Rochester
April 19	*J. H. Barrow*	London
April 17	*Portadown*	Preston
April 20	*Gongon*	Nantes
April 24	*Nancie Thomas*	Manchester
April 20	*Saint Aiden*	London
April 25	*Balmyle*	Rouen

China Clay Imports

A RETURN showing the registered imports of China Clay, including China Stone, into Great Britain and Northern Ireland, from the several countries of consignment, during the month of March, 1924 :

County whence Consigned	Quantity Tons	Value £
U.S. America	20	121

China Clay Exports

RETURN showing the exports of China Clay, including Cornish or China Stone, the produce or manufacture of the United Kingdom, from the United Kingdom to each country of destination, registered during the month ended April 30, 1924.

COUNTRY OF DESTINATION	QUANTITY Tons	VALUE £
Finland	51	140
Latvia	18	27
Sweden	2	10
Denmark	466	1,280
Germany	1,217	3,030
Netherlands	3,729	8,573
Belgium	3,154	5,750
France	4,222	8,138
Switzerland	100	258
Spain	902	2,594
Czecho Slovakia	47	150
Greece	50	266
Egypt	3	6
China	13	85
United States of America	24,493	60,145
Mexico	25	100
Peru	9	20
Irish Free State	14	41
Channel Islands	185	416
Cape of Good Hope	717	1,260
Bombay via other ports	1,625	6,302
Madras	40	160
Bengal	337	1,348
Victoria	1	4
New South Wales	61	176
Canada	40	73
Total	41,521	100,352

April China Clay Deliveries

APRIL proved to be the best month the China Clay industry has experienced since May last year, deliveries amounting to nearly 80,000 tons, thus overtaking the heavy drop in the first two months of this year, and bringing the total for the four months to over 2,000 tons above the corresponding four months of last year. The record of the four months is really better than this, because in last year's figures the shipments of ball clay were included, and are this year not taken into account. With the exception of May last year, when 84,744 tons were shipped, April has been the best single month since pre-war.

The figures were swollen by the number of big consignments for America.

The detailed figures are as follows :—	Tons.
Fowey (including 3,972 tons china stone)	64,424
Charlestown	4,476
Par (including 541 tons china stone)	4,096
Plymouth	709
Newham	243
By rail	5,139
Total	79,087

Total for four months 269,604 tons, against 267,236 tons for the corresponding four months last year.

In addition to the above shipments for April, 2,627 tons of ball clay were shipped through Fowey and 338 tons through Plymouth, all produced in Devon.

An error crept into our returns for Charlestown last month, the total having been 3,100, instead of 1,713 tons, making the total for March 78,342 tons.

Par Harbour Tide Table, May, 1924

(British Summer Time Throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
Thursday	1	4.42	5. 6	12.1
Friday	2	5.27	5.46	12.5
Saturday	3	6. 6	6.24	12.7
SUNDAY	4	6.42	6.59	12.8
Monday	5	7.16	7.32	12.7
Tuesday	6	7.47	8. 1	12.4
Wednesday	7	8.17	8.32	12.0
Thursday	8	8.48	9. 5	11.6
Friday	9	8.21	9.38	10.10
Saturday	10	9.58	10.19	10.1
SUNDAY	11	10.43	11.10	9.5
Monday	12	11.41	—	9.0
Tuesday	13	0.13	0.52	9.3
Wednesday	14	1.30	2. 7	10.0
Thursday	15	2.43	3.14	11.1
Friday	16	3.45	4.13	12.3
Saturday	17	4.39	5. 3	13.1
SUNDAY	18	5.29	5.53	13.8
Monday	19	6.16	6.41	14.0
Tuesday	20	7. 6	7.32	14.2
Wednesday	21	7.55	8.17	13.11
Thursday	22	8.39	9. 4	13.1
Friday	23	9.29	9.52	12.2
Saturday	24	10.18	10.45	11.0
SUNDAY	25	11.11	11.43	10.1
Monday	26	—	0.16	9.9
Tuesday	27	0.53	1.27	9.11
Wednesday	28	2. 2	2.37	10.5
Thursday	29	3. 9	3.39	11.0
Friday	30	4. 8	4.32	11.6
Saturday	31	4.54	5.16	11.11

H. L. VICARY, Harbour Master.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

BOWATER'S PAPER MILLS, LTD., London, E.C. Registered April 16. Trust deed, dated April 4, 1924, securing £300,000 debenture stock and premium not exceeding 3 per cent. ; charged on Northfleet Dockyard, also general charge.

CALDWELL'S PAPER MILL CO., LTD., London, E.C. Registered April 24, disposition in security and a debenture collateral thereto, to bank ; charged on company's paper mills at Inverkeithing, and general charge. *£249,500. March 28, 1924.

CANNON AND CLAPPERTON, LTD., Sandford-on-Thames, paper manufacturers. Registered April 25, order of Court dated April 4, 1924, amending return registered May 2, 1921, to £40,000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue £50 ; also registered April 25, £19,750, £200, £100, £500 and £19,200 debentures, part of £40,000 ; general charge. *£40,000. October 19, 1923.

MEETH (NORTH DEVON) CLAY CO., LTD. Registered May 1, debenture, to bank ; general charge. *Nil. August 9, 1923.

POLEGATE BRICK AND TILE CO., LTD. Registered April 10, £350 debentures ; general charge (except uncalled capital). *£1,000. December 31, 1923.

RIDLEY (W.) AND CO., LTD., Leicester, paper manufacturers. Registered April 11, equitable mortgage, to bank ; charged on land and hereditaments at Eastleigh Road, Leicester.

Satisfactions

CALDWELL'S PAPER MILL CO., LTD., London, E.C. Satisfaction registered April 24, £250,000, registered October 25, 1920.

PORTALS, LTD., Whitchurch (Hants), paper manufacturers. Satisfaction registered May 6, £30,000, part of amount registered May 25, 1920.

The China Clay Trade Review

The Official Organ of the China Clay Industry and the only Journal specially devoted to its interests Published in the third issue of "The Chemical Age" each month.

All Editorial communications should be addressed to the Editor, "The China Clay Trade Review," Benn Brothers, Ltd., 8, Bouverie Street, London, E.C.4. All communications relating to Advertisements, Subscriptions and other business should be sent to the Manager. "The China Clay Trade Review," at the same address. Telegrams—"Allangas, Fleet, London." Telephone—City 9852 (6 lines).

Contents

The Joint Industrial Council

THE good relationship which has existed so long between employers and employed in the China Clay industry was last month subjected to a little annoyance because of the desire of the Dockers' Union to be represented on the Joint Standing Industrial Council.

The Council consists of ten representatives of the employers and ten representatives of the employed, and was set up to adjust any differences that might occur.

The Workers' Union is the men's union of the China Clay industry, and as such is the only officially recognised one, and is co-opted in the constitution of the Joint Standing Industrial Council. We understand that some members of the Dockers' Union approached certain men in the China Clay industry with a view to their joining the Dockers' Union instead of the officially recognised Workers' Union.

With a view to settling this point, a meeting of the Employers' Federation was held on May 26 and a meeting of the Workers' Union on May 27, and on the same day a meeting of the Joint Industrial Council was held.

At this meeting Mr. John Higman was elected Chairman, and Mr. Joseph Harris was elected Vice-Chairman, both until October next.

The meeting unanimously confirmed the contention of Mr. Harris that the Workers' Union was the only union recognised in the constitution of the Council. Satisfaction was expressed with the Constitution and the pleasant relationship that has existed between the Employers' Federation and the Workers' Union.

It is understood that members of the Federation have been advised that it is for the benefit of the industry generally that employees should be members of the Workers' Union only.

It would seem a pity to let anything interfere with the happy relationship between employer and employed which has lasted so long, and we can only hope that members of the Workers' Union will take the advice of their leader and not allow outside influence to prejudice the continuance of the Joint Industrial Council, which was set up for the benefit of both employed and employer.

As with nations, so with trades, a better understanding of the difficulties of both sides can often be arrived at by frequent meeting together of their representatives. This has been very successfully accomplished in the past, and any outside influence which may tend to lessen this good feeling between employer and employed is to be strongly discouraged.

The China Clay industry has passed through some very trying years, and has had great difficulty in finding employment for those that live in the district. The employers have shown a desire to do all in their power to increase employment, and it must not be forgotten that many firms made real sacrifices in the interest of the workers during the time when the trade was practically at a standstill through causes over which it had no control.

It has already been pointed out that though American requirements for China Clay have been good up to the present, this demand is likely to fall away during the summer months.

We draw attention to this fact again as an additional reason for not allowing any outside influence to break the harmony of the Joint Standing Industrial Council in the future.

A Change for the Better

THE wonderful Wembley Exhibition and the recent visits of foreign royalty to this country have all helped to cement friendship with other nations, but the man who has done more to bring about this happy state of affairs is undoubtedly our present Prime Minister and Foreign Secretary—Mr. Ramsay MacDonald.

However much some of us may dislike his policy as a whole, the Foreign Secretary has done more to strengthen friendship between nations than most of his predecessors, and for this we are grateful to him.

Lack of friendship between nations is a bad business and bad for business.

No one feels the effect of bad relationship between nations quicker than the China Clay industry, with its high export trade. In the Continental markets for China Clay there has been distinct reluctance to make heavy purchases owing to the political situation, so that China Clay producers have a very real interest in the policy of events across the water.

The change for the better since Mr. MacDonald came into office has been marked and will undoubtedly have the effect of increasing trade.

Fortunately America has been the friend of the China Clay trade, and since the war has increased her orders, but the Continental trade has a long way to go before it equals its pre-war figures.

It is a weary waiting game for currency to become stabilised and for nations to settle their differences, and one is inclined to say, "But things like this, you know, must be after a famous victory." We believe, however, that very much can be done to hasten the desirable end when all nations will be working for peace and prosperity, and anyone who endeavours to strengthen old ties instead of severing them, by a policy of friendship between nations, has, we are sure, the hearty support of the China Clay industry. As a trade paper, we are not concerned with party politics, but we cannot say politics for the politicians and business for the business man, and leave it at that. The two are so interwoven that a particular foreign policy may produce disastrous results upon our export trade. This has happened already, as in 1922, when the crisis with France over the reparation business was immediately reflected in the cancelling and holding up of orders for China Clay.

It will therefore be appreciated that in so far as the interference of politicians hampers the reconstruction of European trade, so will the China Clay industry feel its effect—inflicting injury both upon the producer and the employee.

We know that the China Clay producers are doing their utmost to recover old markets, but the falling rate of exchange and crisis to which we have referred make it difficult, and in some cases impossible, to make headway. Is it too much to hope that Mr. MacDonald's policy of concilliation may succeed in helping the spring of industry to flow freely again, and that we may soon fully recover our Continental export trade?

Wonderful Wembley

THERE is very much to interest China Clay visitors to the British Empire Exhibition at Wembley. Quite apart from the visit to the Malay Section, where will be found a dump of China Clay and some rather coarse pottery-ware made from it, there is to be found in the Palace of Industry a paper-making machine at work. This exhibit is attracting considerable attention, and will be of special interest to the members of the China Clay trade, as the greater proportion of the China Clay sold goes to paper mills.

The machine, which is running, was started by the Empire Paper Mills (1922), Ltd., and whilst under their superintendence has been visited by thousands, keen interest being taken in all the operations. It will probably be the first time for many in the China Clay industry to see the actual process of paper-making, and the formation of the sheet on the wire is exceedingly interesting. Messrs. Peter Dixon took over the charge of the machine after the Empire Paper Mills. A brochure issued by the Paper Makers' Association contains full information of those who have contributed to making this exhibit so successful.

There is also a very large section devoted to pottery of all kinds, in the manufacture of which China Clay plays an important part. The Chemical Section, too, is well represented, and will undoubtedly be visited by China Clay representatives.

An idea that a visit to Wembley is a costly undertaking is erroneous. The admission charge of 1s. 6d. is all anyone need pay for a most enjoyable day there. There is far more than a visitor from Cornwall will be able to see in a single visit, all free. Of course, a visit to the Amusement Exhibition may be an expensive item in the day's programme, but this will depend upon individual tastes. What we want to point out is that there is no need to fear that a most enjoyable and entertaining visit cannot be made without considerable expenditure. There is more than enough to see for the entrance fee alone, whilst the beautifully laid out grounds, in which some of the finest bands in the world are playing, are an attraction in themselves.

We know that there are many visitors from the China Clay districts who will be visiting Wembley, and can assure them that they will not be disappointed.

China Clay for Clarifying Oils

A GOOD deal of interest is now being manifested in the scope offered for the use of China Clay in different branches of the oil industry, especially so in the clarification of petroleum and the production of other highly refined oils largely used in commerce.

The clay used for the purpose is that known as colloidal clay, a highly refined product produced by a variety of processes from ordinary China Clay. Colloidal China Clay is now being produced on a larger scale by different China Clay producers to supply a gradually rising market for this highly refined product.

Colloidal clay for the purpose of the clarification and purification of crude oils, as well as in the production of aniline dyes, lithographic inks and margarine, is now being increasingly used as a catalyst, an element having the power to effect a change in the composition of the material in connection with which it is used without changing the character of the catalyst itself.

The colloidal clay used in the production of various grades of oils is used in various forms, sometimes in a desiccated state and sometimes as a filterer in some such form as certain grades of sand and other materials are used in filter beds for the filtration of water.

The development of the use of colloidal clay as a catalyst in the treatment of crude oils for various uses is one that is worth the attention of China Clay producers, especially those firms who are now paying increasing attention to the production of this colloidal clay.

The question may be asked: What should be the characteristics of that highly refined material produced from China Clay to entitle it to the description "colloidal clay" for use as a catalyst? As an eminent chemist has described it, colloidal clay is clay in such a fine state of diversion that when mixed with water under certain conditions it forms a colloidal solution, that is, the clay remains in colloidal suspension and does not settle out; moreover, in straining the solution through blotting paper it passes through unchanged. The main property to note is that in the colloidal state the substance consists of very minute particles varying in size from ·000004 in. to ·000000004 in. It is to the production of a material with such a fine texture as this that some China Clay producers are now paying attention, with a view to its use for such special purposes as those mentioned and in the manufacture of certain kinds of toilet soaps.

Characteristics of English China Clay

CHINA Clay and stone were first dispatched from Cornwall in 1759, when small quantities were sent to the Staffordshire potteries. Mid-Cornwall was the scene of the first and most productive deposits, but deposits have been later discovered in South-West Devon at Lee Moor, and later still in West Cornwall and North Cornwall.

Advantages that favour the development and production of the China Clays in the West of England are peculiar to them and account for their pre-eminence in the markets of the world. These are some of them: (1) Large size of the deposits and their convenient situation close to the surface, extending over wide areas, affording facilities for cheap working and warranting the laying-out of treatment works on a large scale; (2) careful preliminary preparation, which secures uniformity in composition of the product sold under any given brand to a degree nowhere else attained; (3) high average quality and good colour of the clays, especially bleaching clays as regards colour, as compared with the average quality of clays from any other country—the best English clays cannot be challenged by any foreign clays—(4) proximity to shipping ports, and the convenient geographical position of Cornwall, which offers facilities to outward-bound ships for loading rapidly a material that makes better ballast than either coal, sand or water.

In addition to the natural advantages that so favour the Cornwall and Devon clays, the producers generally have taken full advantage, as capital has permitted from time to time, of all the modern scientific methods for cheapening production so as to successfully meet competition. Although at the beginning of the industry little in the way of equipment was used, at the present time steam engines, suction gas and crude oil engines are used for generation power, while its transmission by electricity has been developed on a large scale in recent years.

The necessity for these modern methods is evident when it is realised that for every ton of clay produced about 50 tons of water have to be pumped an average height of 150 to 250 feet, a ton of earth has to be removed, and four to six tons of sand lifted from the bottom of the pit to the top of the dumps. These are the operations involved in the production of the clay—the tramming of the wet clay from the tanks on to the pan of the dry, the throwing of the dried clay from the pan to the linhay, being additional processes before the China Clay is ready for dispatch. Having regard to these facts and the cost of getting the clay from the works to the seaboard, buyers should feel that to be able to get this commodity free on board at as low a figure as 26s. 9d. per ton for the cheapest grades it is worth the money.

A "Farrow" Venture in China Clay

THE report in the daily papers that Mr. Farrow, of Farrow's Bank, will shortly be about again, reminds us of a report which we published in THE CHINA CLAY TRADE REVIEW in 1921, and reads as follows :—

The bank's connection with the ball clay trade began in 1912, when it was decided to commence operations in clay. Finding it impossible to secure an established business, or acquire land that had been already worked for ball clay, a "Farrow" company was formed early in 1913 to open up new clay quarries in outlying districts. The machinery was to be of the very latest, old methods kicked over, obsolete ideas scrapped, and everything was to have been on an imposing scale. The Blondin, power navvy, runway, crane and wagon—gas, steam, electric, oil or water-driven—all were to find a place. Labour was to be paid piece-work. Sidings were to be constructed, regardless of cost, to bring within reasonable distance those virgin clay deposits of vast area which up to then it had been impossible to work. The old style of clay-getting by shafts, sunk almost invariably in dangerous ground, entails great wastage of timber. Pumping has to be carried on day and night at numerous engine houses, and large quantities of coal consumed. In the new high-lying quarries little, if any, timber would be used; there would be few water troubles and no costly coal bill. Then, again, in the shafts only highly paid miners are employed, whilst in the open work a good deal of unskilled labour could be utilised.

Development work was to have been carried out on the following lines. Upon opening a new quarry, the meat earth was to have been saved back as customary, but the next layers of gravel and rough clay to be made into common brick and burnt in clams. These bricks were to be used for the building of platforms, landing places, dumps, etc., and for the erection of workmen's cottages, of which it was proposed to put up two hundred. There was also to have been a brick and sanitary pipe works, and kilns for burning large, coarse rough ware, mainly for distribution in the western counties. Another works would have dealt with the purification of clay for making saleable certain qualities usually thrown away. Bijou potteries were also to have been built in villages, where small articles, such as badge buttons and dolls' heads, would be made. Where possible, existing barns or sheds were to have been adapted for manufacturing purposes, and a genuine attempt made to revive the rural pottery which at one time flourished in England, producing pitchers.

Now for what actually took place. The works were opened and 98 men taken on, and machinery brought from all parts of the kingdom. The clay crane employed locally cost pre-war price £12 10s., the electric crane at the new works could not have been put in position under £400.

Three kinds of clay were found—a yellow clay that burnt red, a bright-coloured clay, and under a bed of lignite a black clay. A stone quarry was commenced, and a tractor and steam cart purchased. Next a site for a siding was chosen, the trees and brushwood cleared, and ten thousand tons of stone brought across country to convert a swamp into dry land. A small brick-making plant was installed, and many hundred thousands of good bricks made and fired in "clams" by an old man who had learnt his trade forty years before in the brickfields of Kent and Middlesex. An ancient stone building, then used as a barn and pigsty, but once a village foundry, was taken on lease and turned into an up-to-date pottery.

Workers from Staffordshire

Although rather out of the way, workers were secured from Staffordshire, by forwarding the railway fare first, which is generally considered a bit risky, but there was no trouble, although one man, a splendid worker, but with the old-time Staffordshire potters' peculiarities, came a week later than arranged, very weary and footsore, and owned to having unfortunately missed the train at "Bushlum" (Burslem), and walked down. The pottery was well lighted up by electric light, and power for the potters' machinery was also supplied from the same source, a generating station two miles off, where, instead of coal, lignite was the fuel employed. There was, in addition, supplementary power in the shape of a fine oil engine at the pottery, and a pair of large gas engines at the brickworks. Arrangements were also being made to harness a brook running through the property, in spite of an expert's verdict—a verdict applicable to most Devon streams—that there would be too much water in the winter and too little in the summer. To ensure a good supply of drinking water a firm of well-sinkers were employed; a fine flow of water was the result at quite a shallow depth, but the villagers found their wells had suddenly gone dry. The water was shut off and boring continued to a depth of nearly two hundred feet, at about 20s. per foot, including the tubes, but without finding any water.

Clay the Wrong Colour

In spite of many drawbacks, there is no doubt that if the clay had burnt a right colour the place would have proved a gold mine to Farrow's, but owing, says a Frankfort-on-Maine chemist, to its high content of iron-aluminium-silicate, the colour when fired was most disappointing, and only two firms were interested sufficiently to try a few sample trucks. Like similar concerns, the works shut down at the commencement of the war, and, as far as the clay-getting is concerned, are not likely to reopen, as plenty of the same clay can be had very much nearer the railway, which is a consideration. One thing this costly experiment has shown is that, with good men and machinery, clay taken right out of the earth and tipped into a steam cart without the costly process of heaping and stacking can be put on rail at a very low cost, and it seems quite possible that a big demand might spring up for some of the many millions of tons of the very pure and highly plastic clays in Devon (provided the price was right) in spite of their colour.

Mica Clay as Fertiliser

IN the trade, mica China Clay is classed amongst the cheapest of the common China Clays and is very largely used. Mica is the name given to the residue left after the best grades of China Clay have been worked out. But it retains certain valuable properties which the pure China Clay does not possess and one of these is potash. The presence of this fertilising property, amongst others, confers upon mica China Clay that quality that is looked for by manufacturers of chemical manures who use it in varying quantities.

Mica also retains deodorizing properties which are worked out of the pure China Clays. Many years ago a well-known firm of chemical manufacturers made the discovery that by a mixture of mica China Clay with two other inexpensive ingredients a compound resulted that proved an excellent purifier of sewage treated on the septic tank system.

Chemical Analysis

The following is the chemical analysis of a typical sample of mica China Clay :

Silica, 48·06; alumina, 35·51; ferric oxide, 1·33; lime, 0·26; magnesia, 0·43; potash, 2·10; soda, 0·46; water, 11·77—99·92.

An expert on chemicals derived from minerals gives his opinion of the mica as follows, after a sample in powdered form had been submitted to and been examined by him :

"The powder is excellently ground and is very smooth and uniform in texture. I am not surprised to hear that it makes a good fertiliser, to which end the fineness decidedly contributes (a) by more readily mixing mechanically (as opposed to chemically) with the soil, thus making it lighter and more porous and letting the oxygen of the air get into it more freely, but also (b) the more important, it helps the potash to become more soluble, as the carbonic acid in the rain can attack the other constituents and set free the potash.

"*With reference to the chemical constituents which give this potash its fertilising value, this is undoubtedly the potash, although, as mentioned above, the fine powder as such is also of service mechanically.*

"The action of potash on the soil and on plants is not entirely known, but all the evidence points to its principal 'role' being to persuade the other more lazy atoms of potash, already in the soil, to bestir themselves and get into the plants and do some work. There are other substances, such as lime, salt, etc., which have to some extent the same persuasive effect, but the potash atoms are inclined to be aristocratic and exclusive."

In the process of decomposition by the action of water and air, over a great number of years, the character of China Clay undergoes a change, and though in course of time during

the period of decay the potash contents ascertainable by chemical analysis are apparently lessened, the elements that do remain taken together represent a higher fertilising value than the lower percentage of potash judged by itself would lead a casual observer to suppose.

Its Value as Growth Produce

Its value as a growth promoter must be judged by what it actually performs in practice than from its potash contents alone. In Cornwall this powder has been used by local cultivators for many years for promoting the growth of certain crops with very beneficial results. Its less extended use among cultivators has been due to lack of knowledge as to its value. Further proof of its fertilising value is seen in the fact that seeds blown promiscuously by the wind on to the material in the tanks (in which the material is stored in a wet state preparatory to being dried), immediately sprout and flourish abundantly. Before the war large quantities of this material were shipped to the continent, Germany being a very large consumer and using it in the manufacture of chemical manures.

A well-known county council agricultural organiser in recommending the use of the powder speaking of its potash value says: "Manure manufacturers should be willing to pay a good price for it." Basing the value of the powder solely on its potash contents, he says it is worth £2 per ton. He adds: "I see no reason why it should not be mixed with other fertilisers." He recommends it for light soils. An agricultural analyst, in speaking of its suitability for heavy soils says: "If one were to mix a fine powder of this sort with soil of a clayey nature it would mechanically open up the clay and make aeration and drainage more efficient."

Similar Uses as China Clay

While reference in this article has been to the special qualities attaching to mica clay as distinguished from those possessed by the better China Clays to a lesser extent if at all, this common grade of clay is also in demand for most of those purposes for which China Clay is used but confined to the cheaper manufactures. It is used as a cheap paper filler and bleacher and in various forms of cheap pottery, such as common domestic ware, jam pots and so on. It also enters into the manufacture of asbestos and cheap linoleums. Some mica China Clays are well washed and compare favourably on this score with many China Clays.

China Clay in the Textile Industry

READERS will see from the following receipts how China Clay enters into the finishing of cotton, linen and silk. China Clay is employed to give weight and feel to the articles. The following are specimens of some of the finishes.

I. Pure R. Finish.—Make a corn starch liquor of 8° Twaddell, and to 50 gallons add 10 of China Clay, 10 farina, and soap softening to the required degree. The articles are thoroughly dried on the drying cylinders. The mixture is put into the trough, the clothes prepared on a damping machine and then stiffened on a mangle with the mixture.

II. Shrunk R. Finish.—Corn starch liquor 50 gallons (8° Twaddell) is mixed with 10 of China Clay paste, 15 lb. mineral white and 5 lb. white soap softening. The goods are mangled through hot water, prepared on the drying cylinder, and then stiffened on a three-bowl mangle with the mixture.

III. S. Finish.—Crystal starch liquor, 8° Twaddell, 50 gallons; China Clay paste, 5 gallons; mineral white, 10 lb.; barytes, 10 lb.; good soap softening, 3 lb.

IV. B. Finish.—Mix 112 lb. flour and 20 gallons of China Clay paste thinned with water. The goods are mangled in hot water, and the mixture applied on a back filling mangle.

V. Madapollam Finish.—Chiefly a foreign finish, dull lustre, full mellow feel. The stiffening is made with 12 cans of flour paste and 4 of China Clay paste for 18 by 18 cloth.

VI. Canton Finish.—A dull finish made with 20 gallons of China Clay paste, 5 mineral paste and 50 of starch paste (12° Twaddell).

VII. China Finishes.—Heavily weighted, bright, hard finishes for the China and Egyptian markets. A common mixing for 15 by 15 cloths is—starch (12° Twaddell), 10 cans; China Clay paste, 4 cans; mineral, 1 can—all boiled to 140° F.

VIII. New China Finish.—This is filled on both face and back. Filling for the face is corn starch liquor at 10° Twaddell. Back filling, 20 cans China Clay paste, 5 of mineral (wet), 20 of starch at 12° Twaddell, and 20 of flour paste.

Pattern Finishes.—For 18 by 18 cloths, 2 cans of farina, 2 of China Clay (wet), 4 water, 6 lb. softening. Heat to 200° F. and then make up to 6 cans with water.

For 16 by 17 cloths, mix 6 cans of farina, 3 China Clay paste, 6 lb. softening, 1 lb. glycerine, 4 cans of water. Boil to 180° F. and add 2 cans of water.

Special Finishes.—White Shirtings: For 19 by 21 cloths, starch, 50 lb.; water, 2½ cans; China Clay paste, 3 cans (with 4 cans of water previously added); glycerine, 1 quart; blue to shade.

Cambric: of fine quality, crystal starch (20° Twaddell), 50 gallons; China Clay paste, 4 cans; mineral, 2 cans; farina, 1 can; blue to shade.

Zephyrs and Counterpanes: Best potato starch, 44 lb.; China Clay (previously steeped for a few hours in water), 33 lb. When these are well mixed add dextrin, 33 lb., and make up to 77 gallons with water. Boil up and add 4 lb. of pure tallow and about 5 oz. of blue.

Weighting Finish: Low grade cloths, especially those for export, are frequently weighted with—sago, 9 lb.; rice flour, 9 lb.; farina, 15 lb.; China Clay, 45 lb.; ultramarine, 2 oz.; soluble oil, 2½ lb.; water, 80 gallons.

Finer Weighting Mixture.—Boil together starch, 15½ lb.; farina, 15½ lb.; China Clay, 10 lb.; soap 2 oz.; glycerine, 2 oz.; ultramarine, 4 oz.; water, 35 gallons.

[*The Textile Industries*, in 8 vols. 1911. W. Murphy.]

The Product from Dehydration of Kaolin

THERE are two different points of view, according to Messrs. V. Agafonoff and W. Vernadsky, with regard to the product from dehydration of kaolin. On the one hand it has been described (obtained by heating at 450° to 550°C.) as *heterogeneous*, as a *mechanical mixture* of Al_2O_3, and SiO_2, and on the other as a homogeneous substance $Al_2Si_3O_7$, free kaolin anhydride (anhydrous leverrierite). The following observations and experiments place homogeneousness of the product beyond all doubt.

The experimenters studied the white kaolin of Aïn Barbar (Constantine), Algeria, in the museum collection. Under the microscope it is homogeneous and formed of little crystalline scales, the contours of which are not clear, which act on polarised light in the inclined sections; the transversal sections have a negative elongation.

Water in extract SO_3 and Cl, in small quantities.

Analysis gave the following results:—

SiO_2	46·65	Theoretic ..	46·5
Al_2O_3	40·17	$H_2Al_2Si_2O_8H_2O$ ..	39·5
Loss in fire ..	13·78		14·0
	100·60		

The product from dehydration was obtained by heating in an electric furnace at 450° to 550°C. The density of the powders was determined in bromoform (mixture of ether) at the laboratory temperature:—

Aïn Barbar kaolin	2·58–2·59
Product from dehydration	2·32–2·38

The powders are perfectly homogeneous in liquids.

In preparing a mixture of Al_2O_3 and SiO_2 in powder, it was found, after heating to 550° to 560°C, that it is heterogeneous in bromoform. In bromoform with density 2·75 a part, SiO_2 floats on the surface and the other, Al_2O_3 settles on the bottom. In that with density 3·3 the greater part of Al_2O_3 remains on the bottom. Thus its density is greater than 3·3.

Under the microscope *the product from dehydration is homogeneous*. Loss of water has not perceptibly changed the aspect of the kaolin powder. There are the same briefringent scales in elongated inclined sections optically negative in the transversal sections. The index of refraction (white light, immersion method), is as follows:—

Aïn Barbar kaolin	1·555
Product from dehydration	1·513

Absorption of a methylene blue solution in kaolin powder and the dehydration products give intense *very homogeneous* coloration. The artificial mixture of SiO_2 and Al_2O_3 on the contrary, treated in the same manner, is *heterogeneous*. The grains of SiO_2 are not coloured, whilst those of alumina colour.

Alseveor China Clay Pit

Promising Development of New Work

THE Alseveor China Clay pit, situated at Trethurgy, St. Austell, in the famous Carclaze district China Clay belt, is one of those works which was commenced on the eve of the war, and reached a productive stage during the war. It lies

THE EARLY STAGES OF THE OPENING UP OF ALSEVEOR CHINA CLAY PIT. THE SEA AND FOWEY POINT IN THE DISTANCE.

between Messrs. Loverings' Carclaze Works, Mr. E. J. Hancock's West Carclaze Works, and Messrs. Parkyn and Peters' Pentruff Works on the west, and Trethurgy China Clay Works on the east. It is one of the works now being managed under the managing directorship of Mr. E. J. Hancock, and has recently been amalgamated with the Trethurgy China Clay Works, both works being now operated by the Alseveor China Clay Co., Ltd.

PHOTO SHOWING MICAS AND SETTLING TANKS.

Surface works showing series of refining troughs, known as micas, over which the liquid clay, pumped up from the pit below, flows, leaving, in the course of its progress, any coarse material behind in the troughs. This coarse material is known in the trade as mica, from which the term "micas," as applied to the mica drags or troughs, is derived. The settling tanks are to the right of the *picture.*

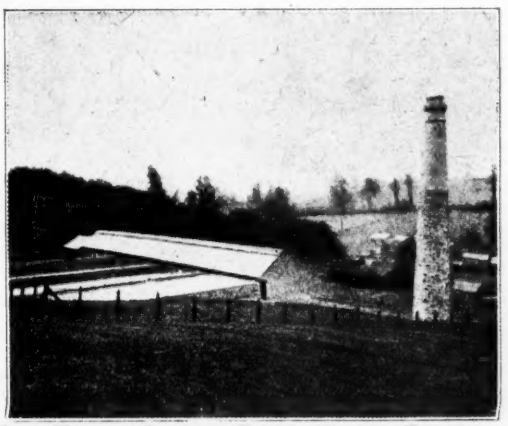
Alseveor produces a good medium paper-making and bleaching clay, a natural blue vein encountered in the course of working imparting to the product that purity of colour which is a desideratum in clays used in the bleaching and paper-making trades.

The pit has recently undergone considerable development, the quality of the clay continually improving as the pit is opened up. The pumping plant for lifting the liquid China Clay from the pit to the surface is operated by a suction gas engine and plant, the winding of the overburden and sand being operated from a separate steam engine. As in all modern China Clay works, the point at which the clay is produced is connected with the dry at Tregrehan by means of a pipe-line, the works being so situated as to admit of the clay being conveyed in this way by gravitation, so that with the exception of the initial pumping of the liquid clay from the pit to the settling tanks no further pumping is necessary.

At the time when the works were laid out there were difficulties in the way of securing a site actually on the railway, but the company got as near to this as possible by securing a site which is in proximity to Par Harbour and St. Blazey Railway Station, the G.W.R.'s clearing centre for Fowey.

FRONT VIEW OF ALSEVEOR DRY OR KILN SHORTLY AFTER COMPLETION.

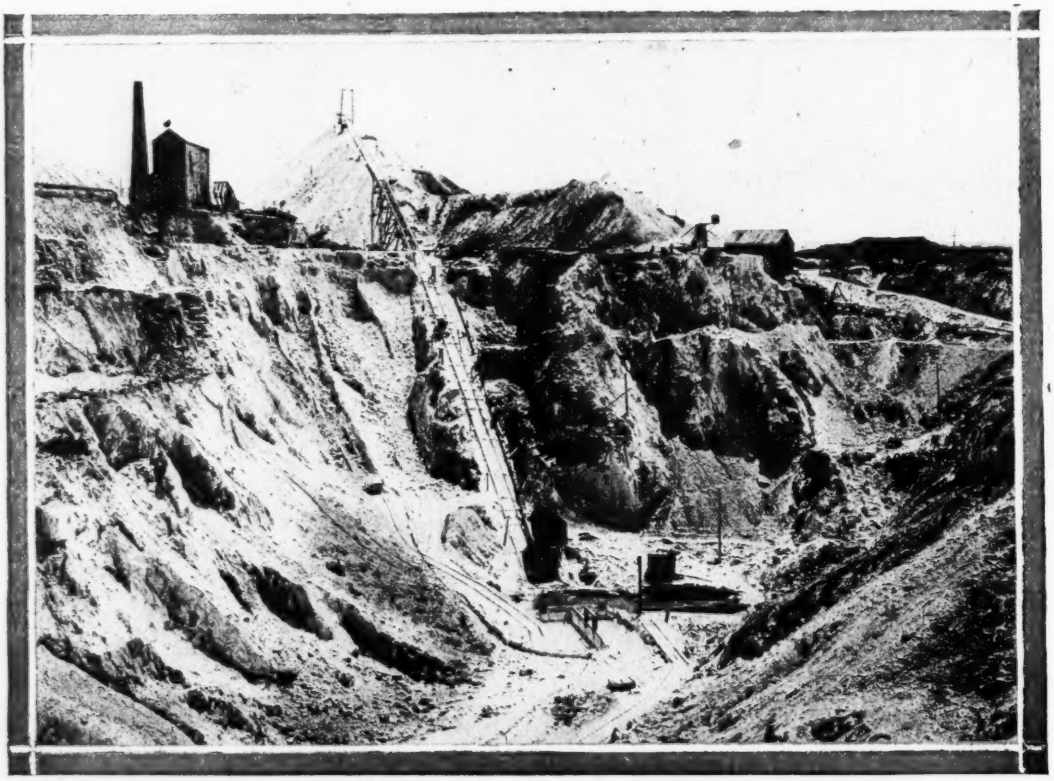
The company have a fine dry at Tregrehan with a capacity of nearly 10,000 tons, which, in association with Trethurgy China Clay Works, places this company in a position to supply both bleaching and potting grades of clays. From a production point of view both works have excellent prospects, and in the near future are likely to participate in the general prosperity of the industry, signs of which are already apparent.

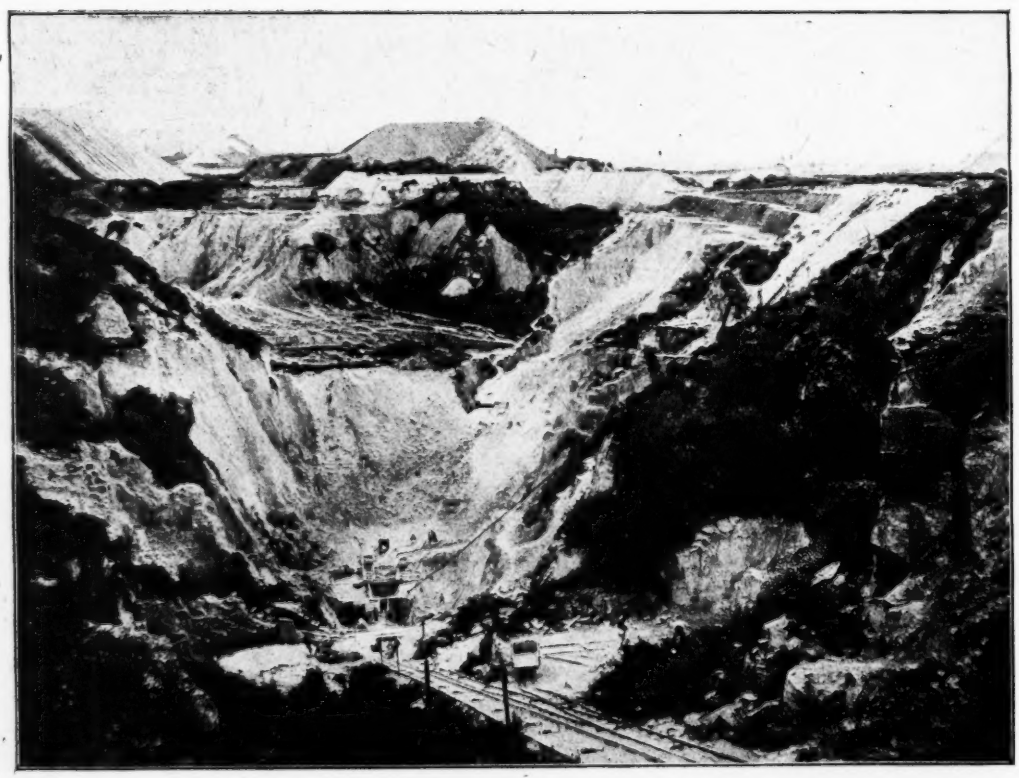


REAR VIEW OF ALSEVEOR DRY OR KILN AT TREGREHAN.

The chimney stack erected away from the main building to permit of extension. The clay is run down by pipe-line from the works at Alseveor, Trethurgy, about 2½ miles distant. Its capacity is between 8,000 and 10,000 tons per annum.

The illustrations of the Alseveor Works will give readers a very good idea of the pit and plant, and although as stated considerable developments have taken place since these photos were taken, yet they show the general lay-out of the works.





Two of the Clay Pits of ENGLISH CHINA CLAYS, Ltd.

China Clay Notes and News

China Clay in Ireland

Following the result of the analysis of a sample of silica clay, taken from a mine situated at Rostellan, Aghada, about four miles from Midleton, Co. Cork, investigations have already begun towards the development of this most important and only industry of its kind in Ireland. The mine, which is situated quite convenient to the sea, has not been worked since the year 1816, at which time it was abandoned for some unknown reasons. Minute observations made on the spot and on the surrounding district revealed a vein which could be traced along the surface for three-fourths of a mile square, with a depth unknown. During the past month samples of this silica clay have been forwarded to different Governmental Departments and to private firms in Ireland and London with a view to analysis. It is stated that the results, so far, received have indicated the mineral to contain as much as 95 per cent. silica. Recently, samples of this silica were examined by representatives of the Ministry of Industry and Commerce at Cork, and by the officials of the Cork Industrial Development Association, who promised to give every possible assistance in helping to revive this important industry.

From the China Clay formerly produced from this mine china was manufactured. Reference to the occurrence of the mineral as a " vein," indicates that its formation differs from the China Clay " deposits " of Cornwall and Devon.

Clay Ship Fire

Lloyd's agent reports on May 21, that the British steamer *Ronda*, discharging a cargo of China Clay, caught fire whilst alongside the wharf at Portland, Maine, on Tuesday, the 20th. The fire, which broke out in the engine-room store-room, was extinguished, but the engine-room store was destroyed and four shell-plates slightly buckled. The cargo apparently was undamaged. The *Ronda* is owned by the Bowring Steamship Co., Liverpool.

Spanish Port's Clay Trade

H.M. Consul at San Sebastian in his annual report for 1923 on imports into the port of Pasajes, stated that China Clay was represented by 4,667 tons.

Port Bans China Clay Trade

Objection has been taken by St. Ives (Cornwall) through their Council, to the use of the harbour for the shipment of China Clay by the Porthia China Clay Co., on the ground that it would interfere with the present amenities of the place as a centre for artists and visitors and be a detriment to the fishing industry. A vigorous correspondence has passed between Captain Denis Shipwright—who married the daughter of the late Sir Edward Hain, the shipowner—who has been responsible for the development of the Porthia China Clay Works near St. Ives, and the St. Ives Council. The upshot of this has been that the Company have now decided to give St. Ives the go-by and ship from another port.

Death of China Clay Boiler Inspector

The death has occurred at St. Austell, at the age of 87, of Mr. Charles Jenkin, who for many years was engine boiler inspector at the West of England and Great Beam China Clay Works of English China Clays, Ltd., previous to their amalgamation. Previous to his appointment at the West of England Works, Mr. Jenkin was a noted boiler maker in the old tin-mining days, when the iron foundries in the St. Austell district were in a very flourishing condition owing to the introduction into the tin and clay mines of the Cornish Beam engine. Deceased was well known in the district and was a prominent member of the P.S.A. Brotherhood, the old Bible Christian Choir, and later of the Baptist Church, and was also one of the oldest Good Templars in the district.

How Parkyn and Peters was Started

Mr. F. Parkyn, whose firm has clay works in the neighbourhood of Trewoon, responding to the toast of " The Visitors," said it gave him very great pleasure to be present to help forward such a scheme for the advancement of education in that parish. As regards the China Clay industry, he was anxious to disillusion people as to fortunes being made so easily as imagined, for it involved very hard work for masters and men. He went on to tell the story of how his firm came into their Burngullow works by an accident, and how the firm of Parkyn and Peters originated. Many years ago he saw an advertisement of a China Clay works for sale in *The Times*, and on making inquiries discovered that it was the works from which he had been buying China Clay for years. At that time it was not paying. He spoke to his friend, Mr. Woodman Peters, before he purchased it, who agreed to take a moiety. He found Mr. Peters a most excellent partner, who thought of nothing but work morning, noon and night. Mr. Peters boasted that he started as a clay labourer, but he finished up, through hard work, a very successful man. (Mr. Peters left an estate of £98,000.) Had Mr. Peters not started in the clay trade he would have made his mark anywhere, for he had a brilliant brain and was an indefatigable worker. The accident he had referred to accounted for his own association with that parish. His firm had done their best to develop the resources of the place and had turned out from their works a total of 1,300,000 tons of China Clay.

Miss Lilian Stocker's Coming-of-Age

The coming-of-age of Miss Lilian Stocker, eldest daughter of Mr. T. Medland Stocker, J.P. (Joint Managing Director of English China Clays, Ltd.), and Mrs. Stocker, of " Trelawney,"

MISS LILIAN STOCKER.

St. Austell, was celebrated on May 28, when some 100 guests assembled at a reception and dance held in the town. The Church Schoolroom, where the function was held, was converted into a scene of rustic beauty representing a garden, evergreens and flowers being brought from the gardens of " Trelawney."

The guests were received by Mr. and Mrs. Stocker, who were accompanied by their three daughters—Lilian, Madge, and Kitty. Mrs. Stocker was wearing a dress of black georgette. Miss Lilian Stocker was the centre of interest, and was attired in a dress of white charmeuse with an overdress of georgette. Miss Madge Stocker wore a beautiful dress of white satin relieved with marabout, and a collar of real Brussels lace. Miss Kitty Stocker was dressed in white chiffon taffeta. Dancing to the strains of the St. Austell Elite Orchestral Band was kept up until the small hours of the morning. Miss Stocker was the recipient of a number of beautiful presents in honour of the auspicious event.

List of presents :—Daddy, diamond ring ; Mother, gold wristlet watch ; Madge, turquoise and pearl brooch ; Kitty, silver clock ; Mr. and Mrs. Scott, gold necklet ; Dr. and Mrs. Shaw, water colour ; Mr. and Mrs. Grenfell, silver and cut-glass scent bottle ; Mrs. J. B. Stocker and family, silver photo frame ; Mr. and Mrs. H. Stocker, cheque ; The Misses Ann and Rockie Stocker, cheque ; Mr. Ernest Stocker, perfume ; Mrs. Bullock, silk stockings ; Mrs. John Gaved, manicure set ; Mr. John Gaved, perfume ; Mr. and Mrs. Carter, travelling clock ; Dr. and Mrs. Moore, Fuller's chocolates ; Mrs. Smart, pair silver candlesticks ; Mr. and Mrs. Lyon, ivory and silver Prayer Book ; Mrs. Seed, camisole ; Mrs. Hove, powder puff ; Mr. and Mrs. Horne, cut-glass powder jar ; Mr. and Mrs. Sidney Smith, Mrs. Hodge, Mr. and Mrs. Bees, Mr. and Mrs. P. Warne, and Mr. J. Phillips, opal pendant ; Mr. and Mrs. Pettifer, manicure set ; Mr. and Mrs. Davies, silver inkstand ; The Misses Higman, Smith and Smallwood, silver powder box ; Mr. and Mrs. T. J. Smith, silver and cut-glass scent spray ; Miss Violet Barry, silver calendar ; Mrs. Samble, linen Richlieu night-dress case ; Miss Samble, silver and cut-glass scent bottle ; Mrs. and Miss Clunes, cut-glass powder jar ; Miss

Foster, silver and cut-glass jar; Mr. and Mrs. Martin, silver ring stand; Mr. and Mrs. Trout, silver salts; Polly, silver photo frame; Emily, silver photo frame; The Masters Lyon, leather handbag; Miss Kitty Hancock and Mr. Donald Carter, silver photo frame; Mrs. Warne, handkerchiefs; Miss G. King, water colour; Mrs. Fryatt, crêpe de chine night-dress case; Mrs. Penrose, silver and tortoiseshell hair tidy; Mr. and Mrs. H. Ball, London, silver serviette ring; Mr., Mrs. and Miss Riley, aquamarine pendant and chain.

Longevity in China Clay Country

St. Mewan, a China Clay parish adjoining St. Austell, is one of many Cornish parishes noted for the longevity of its inhabitants. Here there are 42 people, out of a population of 500, between the ages of 72 and 83. St. Dennis, with a population of 2,000, has 21 residents between these ages.

Music Success

Our readers will be particularly interested in the success which has been achieved by Miss Evelyn Bray, daughter of Captain James Bray, of "Blackalder," Leemoor, Devon. Miss Bray, who has just entered her teens, has secured the coveted Gold Medal awarded by the Associated Board of the Royal Academy of Music and the Royal College of Music for obtaining highest honours marks in the British Isles in the advanced grade for pianoforte playing. It is all the more

MISS EVELYN BRAY.

exemplary as such distinction rarely comes to the West, and it also illustrates the strong characteristic of the community which the village of Leemoor must be proud of. Leemoor is situated on the slope of the Dartmoor Hills, about ten miles north-east of Plymouth, and this village owes its existence to the very extensive operations of the English China Clays, Ltd., whose high standard clays produced in this remote district are well known in all parts of the world. Miss Bray's father, Captain J. Bray, has been a superintendent of the works for many years, and her grandfather, who was formerly in the St. Austell district, has spent the greater portion of his long life in the development of these China Clay works of Devonshire. For several generations the family have displayed bestowed musical faculties which Miss Evelyn has fully inherited and developed. In addition to the honours mentioned she was equally as successful in her examination in connection with the Trinity College and the series up to the Higher Local Division she emerged with marked distinction.

China Clay Joint Industrial Council

After a lapse of two or three years, in consequence of there being no business to transact, the relations between the employers and employees having been of the happiest description, the Joint Industrial Council of the China Clay Industry has resumed its functions. At a meeting of the Council, on May 24, Mr. J. W. Higman (employers) and Mr. Joseph Harris, (employees) were elected chairman and vice-chairman respectively.

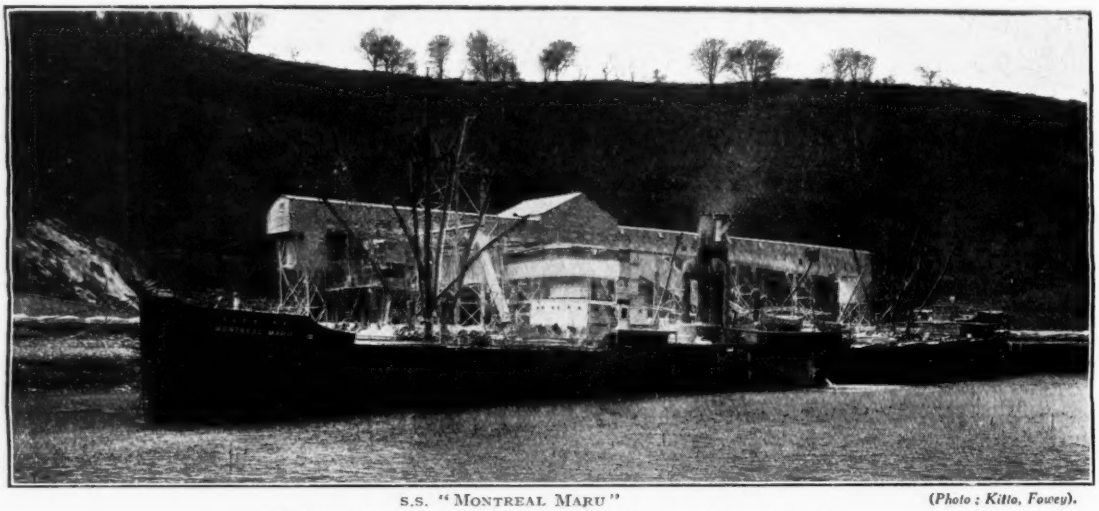
The chief business was to consider an application from the Transport Workers' Union to be represented on the workers' side of the Council. As it was found that the constitution of the Council only admitted of representatives on the Workers' Union, it was agreed that the application could not be acceded to.

Regular quarterly meetings of the Council are to be resumed.

Mr. T. Medland Stocker, J.P. (joint managing director of English China Clays, Ltd.) having resigned as a member of the Council on account of indifferent health, Mr. Henry Stocker (a co-director) has been elected by the China Clay Employers' Federation to fill the vacancy.

U.S.A. Visitors

Mr. C. H. Knight, the President of the Paper Makers' Importing Co., of Pa., U.S.A., and Mr. C. Brian, Vice-President, have just paid a brief visit to England. Considering the brevity of their stay they were only enabled to spend a few days in the China Clay town of St. Austell, where the firm's European branch is in the capable hands of Mr. F. S. Liddicoat. Unfortunately Cornwall was not basking in her usual sun clad garb although it was rapidly approaching toward the end of May. For a week Pluvius appeared in one of her worst moods, and both Mr. Knight and Mr. Brian will return to America with an unfavourable impression of our Cornish summer. Our distinguished visitors were accommodated at Fowey on this occasion where their riparian tastes were well catered for when the climatic conditions and business allowed them to motor up the river and to gaze on the vast shipping operations for the China Clay industry. Our representative made a casual call at the St. Austell office one morning, and with their characteristic urbanity was immediately ushered into the general manager's room and received a cordial welcome. Mr. Knight and Mr. Brian were both leaving for London that night, and no sooner had we settled down for a few moments for a brief impression of the position of the China Clay trade in America than the telephone began to operate. This firm requested a few moments with Mr. Knight before he departed, and another wanted to see Mr. Brian immediately, and other representatives of various China Clay producing firms in the town began to call personally at the office which served to illustrate the importance of the position held by the Paper Makers' Importing Co. and their representatives. Our representative, however, was informed that the China Clay trade with America had been exceptionally brisk for some months, and it may possibly last a few weeks longer. The Presidential elections will be taking place very shortly, and the tendency of the past has been that, generally speaking, trade has been more or less disturbed. There may be an exception to this rule at the next election, but there are few business people who expect such a course. Mr. Knight informs us that the satisfactory progress of the China Clay market for April month was attributable to the activity of business among the pottery manufacturers throughout the States. With regard to the future prospects, Mr. Knight and also Mr. Brian said it was very difficult to give an expression of opinion as there were one or two other forces than the Presidential election which were operating against them. The United States have protective barriers for their internal industries, but there were even some enterprising nations which are climbing over these by cheaper labour. This competition may be arrested before much injury is done to the American manufacturer. Such, however, is the case, and facts have to be faced. With regard to the new Government, there was so much uncertainty that neither Mr. Knight or Mr. Brian dared to predict which party would succeed. Mr. Knight, however, was gratified to inform us that the volume of business done with the English China Clay producers was expanding, and he hoped the present year with all its ominous features would prove no exception to the rule. Before bidding them adieu Mr. Knight said that he believed English clays would hold their own wherever they went, but he remarked with characteristic emphasis "If we can't beat your Cornish clays in America we can easily surpass the Cornish Riviera for her summers, particularly if the week which they had spent in the county was any criterion." However, both expressed a hope that the Cornish summer would come and last all the longer for its late arrival. The most important matter in Mr. Knight's opinion was that of filling clays, and this he would respectfully submit to the producers on this side for their serious deliberation. He gathered the impression that producers anticipated a corresponding increase in the tariff of filling clays to the reduction in price. He would like to disabuse their minds of this entirely as the tariff on China Clay into America was $2·50 per ton, whether the quality be of the best, medium or common grades. Our representative expressed his indebtedness to both for their courtesy and wished them a bon voyage back. Mr. Knight and Mr. Brian proceeded to London in the evening, and if their business engagements in the City permitted they hoped to pay a brief visit to the Empire Exhibition at Wembley.



S.S. "MONTREAL MARU" (*Photo : Kitto, Fowey*).
Which last month took a record shipment of China Clay on board.

China Clay Workers' Band

St. Dennis Prize Silver Band, of which the Hon. H. D. McLaren, C.B.E. (of Messrs. H. D. Pochin and Co., Ltd.) is president, held a very successful bazaar last month by which over £100 was realised. The effort, which was opened by Mr. J. W. Higman, J.P., (of Messrs. J. H. Higman and Co.) was for new uniforms and instruments. St. Dennis Band, established in 1836, are the champions of the West of England, having won the Prince of Wales Championship Trophy four years in succession.

Mr. John Hooper (of Anchor United China Clay Co.) acted as chairman of the Committee, of which Mr. F. Stanley Liddicoat (of Paper Makers' Importing Co.) and Mr. R. Hooper (Messrs. Pochin), and Captain Fred Dyer (of Great Treviscoe China Clay Co., company's works manager) are also prominent members.

Clayopolis's Lady Doctor

Clayopolis can now boast a lady doctor of its very own, for Dr. Catherine Moore, who actively co-operates with her husband in his practice as assistant to her father, Dr. Shaw, is a product of the China Clay industry, she being a granddaughter of the late Mr. Tom Stocker, one of the pioneers of the industry, and a niece of Mr. T. Medland Stocker, of the English China Clays. She takes an active interest in the Baptist denomination, of which her grandfather was the mainstay, and recently opened a successful bazaar in connection with that Church.

Fowey Harriers' Master Resigns

Fowey Harriers' Hunt has received with reluctance and regret the intimation that their master, Mr. J. de C. Treffry, intends to resign next year on account of advancing age. Mr. Treffry succeeded his brother, the late Mr. Charles E. Treffry, the squire of Fowey, who was for many years the master of the Hunt. Mr. J. Hoyle (of Manchester China Clay Co., Ltd.) presided at the meeting at which the resignation was tendered, he and several others interested in the China Clay industry being keen followers of the hounds. He and Miss Ivy Martyn, of Carthew estate, and owner of China Clay lands, were amongst others appointed to consider the future mastership of the Hunt and its management.

Europe and China Clay Trade

Mr. Hart Nicholls, responding on behalf of Mr. John Haworth, the managing director of Great Halviggan China Clay Co., Ltd., with works in the neighbourhood, expressed regret that Mr. Haworth was unable to be present to speak for himself. He was sure Mr. Haworth would be interested in the spirit manifested there that day, and as Mr. Haworth was the president of the famous Besses o' the Barn Band, he would suggest to him that he should make an effort to bring the band down there for the opening to compensate for his absence that day.

Referring to the China Clay industry, he said there was no China Clay employer more interested in the welfare of his employees than Mr. Haworth. The industry had been passing through critical times, and trade since the war had been very difficult on the European continent owing to the instability of the exchanges. When things were more settled there they hoped to get back their pre-war volume of trade, which would be reflected in the greater prosperity of St. Austell and the villages around, and such institutions as they were supporting that day. With the development of science and its application in the opening up of new uses they hoped to see the prosperity of the industry increase, their employees living in peace and contentment and their Church work carried on as they would like to see it.

Death of China Clay Overseer

The death occurred at St. Austell on May 30 of Captain Caleb C. Perry, who was associated with English China Clays, Ltd., latterly as an overseer of their works for over 40 years. He was for many years before his recent return to take charge of the firm's Carran-Carrow works their works manager at their Hemerdon works in Devon. It was as recently as our March issue that we gave some biographical details of Captain Perry's career, *apropos* his installation as Z of the Mount Edgecumbe Chapter of the Royal Arch Masons. He was a Past Master of the Plympton (Devon) Lodge of Freemasons, and joined St. Austell Peace and Harmony Lodge on resuming his asociations with St. Austell. He succeeded the late Captain Paul Peters as superintendent at Carran-Carrow works.

China Clay Workers' 9s. 6d. Trip to Wembley

In response to the English China Clays, Ltd., offer to their employees to visit Wembley on September 5 and 6, at a return fare of 9s. 6d., the original limit of 1,200 tickets has been already absorbed. The company have since been successful in getting the G.W.R. to increase the limit to 1,600, so that employees who have not yet applied for themselves or friends have still the opportunity of securing tickets. The company are having two special trains, which will do the journey through the night of September 5, arriving at Wembley at 8 a.m., returning through Saturday night at 11.30 from Paddington. Each employee is allowed to obtain one ticket for a relative or friend at the return fare of 19s. 6d. Every employee is to be allowed to work up his time lost through visiting Wembley.

Fowey Harbour Official's Death

The death of Mr. J. H. Netherton, a prominent Fowey official well known to China Clay shippers at the port, occurred under tragic circumstances at his home on Whit-Sunday morning, at the age of 43. He rose at 7, and after calling the members of his family went to the lavatory, where his wife was attracted by gurgling sounds and found her husband collapsed on the floor. Before Dr. Jay arrived in response to a summons Mr. Netherton had expired. Mr. Netherton had not been medically treated, but had recently complained of pains in the region of the heart. At the inquest, without a jury, a verdict

of "Death from heart failure" was returned. He leaves a widow and three children.

Mr. Netherton was actively associated with many official and other organisations in Fowey. He was Clerk to the Fowey Port Sanitary Authority, Secretary of Fowey Hotel, of Fowey Tug and Salvage Co., Assistant Clerk to the Fowey Harbour Commissioners and Fowey Borough Council, Assistant Secre- of the Fowey Gas Co. He was also Hon. Treasurer of the Fowey Stevedores' Regatta Committee and a member of Fowey Lodge of Freemasons. He had for many years been in the office of Messrs. Graham (of Messrs. Stephens, Graham, Wright and Co.) and was a much valued servant. He was a hard and willing worker, and much esteemed by all who had any association with him. In connection with the public activities of Fowey he will be greatly missed. We extend to his widow and family our sincere sympathy.

The funeral on June 11th was very largely attended, every phase of activity in Fowey being represented. The W.M. of Fowey Lodge of Freemasons and several officers and brethren attended. Amongst others were Alderman F. H. Knight (Mayor), accompanied by councillors and officers of the Fowey Borough Council, including Mr. H. S. Graham (Clerk), Capt. F. C. Collins (Harbour Master), Capt. R. Bate, Capt. E. V. Piper, Mr. S. J. Samuel, and Mr. H. Paull (Harbour Commissioners), Mr. Frank Parkyn (a director of Fowey Hotel), Mr. J. L. Toyne (of Messrs. Toyne, Carter and Co.), Capt. F. Truscott, and colleagues representing Fowey Tug Co., and Mr. R. Bennett and colleagues representing H.M. Customs.

Amongst a large number of beautiful floral emblems were tributes from Fowey Gas Co., Fowey Harbour Commissioners, Fowey Hotel Co., Fowey Hotel Staff, Fowey Social Club, Fowey Borough Council, Fowey Tug and Salvage Co., Fowey Masonic Lodge, and Fowey Stevedores' Regatta Committee.

A Romance of the China Clay Trade

China Clay was largely represented at a stone-laying function last month in connection with the erection of a new Wesleyan Sunday School in the village of Trewoon, near St. Austell, in the neighbourhood of which are some famous China Clay works.

Mr. James Perry, a prominent China Clay merchant, who is circuit steward of the St. Austell Wesleyan Circuit, presided at a well-attended luncheon, among the chief guests being Mr. Frank Parkyn (senior partner in the firm of Parkyn and Peters), Mr. Hart Nicholls (manager of the Great Halviggan China Clay Co., Ltd., of which Mr. John Haworth of Manchester is the managing director), Mr. Samuel J. Dyer (managing director of several China Clay firms, including Rosevear Clays, Ltd.), and Mr. R. J. Varcoe.

Fields for Research in Refractory Materials

REPEATED relining of furnaces employed in metallurgical processes leads to continual stoppages. The responsibility for these undesirable interruptions almost entirely rests on the quality of the refractory materials used, and therefore the industry of manufacturing the latter holds out a promising field of research.

An example of this may be gathered from a case recently cited, in which the regular life of a furnace was increased from six months to more than 24 months by conducting a careful study of the texture of the refractory bricks used.

In following out the lines of this experimental work on the large scale, one of the most important factors which realised the foregoing economy was in decreasing the porosity of the bricks. The employment of bauxite bricks would be much more extensive if their cracking under contraction and expansion could be efficiently controlled. One producer has already claimed to have accomplished this, and it is evident that the result is by no means improbable. The last grades of fireclays could be improved by the judicious addition of alumina to the clay, until their standard was almost as high as that of bauxite composition.

Many aluminous clays exist in bauxite regions, which on investigation might prove to be of great value for refractory purposes.

The need for special refractories not only applies to the ceramic and metallurgical industries, but to the many new developments in the chemical world in general.—From *The Clayworker*.

Colloidal Clay

SOME years ago we published in the CHINA CLAY TRADE REVIEW an exclusive article by the late Mr. Frank E. Weston, B.Sc., F.I.C., on Colloidal Clay. Since that article appeared a number of China Clay producers are manufacturing a Colloidal Clay and are now selling it to their clients. The method of production varies with each particular firm, but the fact that there exists a market for this finely divided clay has brought enquiries as to the possibilities of an increased sale of this product in the future.

Mr. Weston's article attracted a good deal of attention at the time, and we think we cannot do better than reproduce the article here again.

Mr. Weston says :—

"Colloidal Clay" is a term applied to clay which is in a very finely divided state, and which possesses properties known to the physico-chemist as "colloidal."

The following short description is written with a view to explaining to the non-scientific reader what is conveyed by the term "colloidal."

Everyone is familiar with the fact that when a piece of sugar is placed in a cup of tea and stirred, it disappears; the sugar is said to have dissolved in the tea. Again, ordinary table salt disappears when shaken up with water, that is, it *dissolves* and produces a *solution* of salt in water. In these solutions it is impossible to reveal to the eye the presence of sugar or salt even with the aid of the most powerful microscope yet invented; moreover, if such solutions be strained through blotting paper, even of the finest texture, they pass through the blotting paper unaltered, that is to say the sugar and the salt are still in solution and have not been kept back or strained out of the solution by the blotting paper.

Now let us examine what happens when ordinary powdered starch is mixed with water. As long as the water is cold the starch will not dissolve, no matter how much they are shaken together, but immediately settles out as a sediment in standing. If, however, a thin paste of starch and cold water be slowly poured into boiling water a remarkable change occurs; the starch dissolves and forms a "colloidal solution." Now in what way does this solution differ from a solution of salt in water?

The first and most obvious difference is the appearance of the starch solution; it appears to be cloudy or opalescent. This effect is not due to particles of starch floating about, because the microscope is unable to reveal grains of starch in such a solution, and further, however much water be added the liquid still remains opalescent. On straining the solution through blotting paper it is still found to be opalescent, and no starch is retained in the blotting paper. Finally, if the starch solution is allowed to stand, no starch settles out; thus far the starch solution resembles the salt solution except in its appearance.

There are, however, two very important properties in which these solutions differ. In order to reveal these differences and to explain them it is necessary to refer to some simple natural phenomena.

Everyone is familiar with the appearance of a pencil of sunlight penetrating into a darkened room; the path of the beam of light is clearly traced, and on close inspection it is seen that the beam of light is full of minute particles of dust which are invisible otherwise, even in ordinary daylight, and that these particles of dust reflect the light, scattering it in all directions, thus making visible the path of the beam of light across the room; in the absence of any dust or water-vapour in the air the beam of light would be invisible.

Again, most people have vivid recollections of the long beams of light, proceeding from the searchlights, and stabbing the sky in all directions, almost nightly during the period of the war; it was also very obvious that the intensity of the light along the beam was not the same, in some places being very intense and bright whilst in other places it was less intense, and sometimes entirely invisible; why was this? At different altitudes the atmosphere contained different quantities of dust particles and water-vapour particles, and in those places where the beam was invisible there was an entire absence of these, and hence no reflection of the beam of light, and hence the beam of light was invisible. Whenever a beam passed through a light cloud the beam became very intense owing to the great number of water-vapour particles which reflected the light.

Now if a narrow beam of light be passed through a solution of salt in water, and the solution be viewed through a powerful microscope in a direction at right angles to the beam of light nothing will be revealed to the eye; that is, the beam of light is invisible just as the searchlight is invisible in those regions of the air where no dust particles are present. If, however, a beam of light be passed through a solution of starch, however weak, and it is viewed in the same manner as the salt solution, then the beam of light is seen brilliantly shining in the solution just like the searchlight beam in the sky. Therefore we come to the conclusion that the starch solution does contain particles of starch sufficiently large to reflect light, whilst in a colloidal solution the particles, scattered as to be visible; hence one of the main differences between a true solution and a colloidal solution is that of the size of the particles of the dissolved substance. In a true solution the particles are too small to reflect light, whilst in a colloidal solution the particles, though invisible to the naked eye, or even when viewed through a microscope, are large enough to reflect light and scatter it, thus making visible a beam of light which passes through it. The second important difference between a true solution and a colloidal solution is illustrated by the following. Suspend a small *parchment* bag in a cup, nearly fill the parchment bag with a solution of salt, and then pour water into the cup so as to surround the bag but not reaching to the top of the bag. Allow this to stand for an hour or so; then take out a little of the water from the cup, that is the water surrounding the bag, and taste it; it will be found to be salt water. Thus salt has passed through the parchment bag into the water in the cup. By removing this water from the cup at intervals and replacing it by fresh water it is possible to cause all the salt contained in the parchment bag to pass out into the water in the cup.

Repeat this experiment, but use starch solution instead of salt solution in the parchment bag. No matter how long the arrangement is allowed to stand no starch will pass through the parchment bag into the water in the cup. This difference between a salt solution and a starch solution is typical for all true solutions and colloidal solutions.

The explanation of this phenomena is simple. In true solutions the particles of the dissolved substance are so small that they can pass through parchment easily, whilst in colloidal solutions the particles are too large. The reason that solutions like starch are termed colloidal is because the phenomena of colloidal solutions were first noted with such substances as glue or gelatine.

There are many other properties peculiar to colloidal solutions which render them valuable in manufacturing processes. It should be pointed out that colloidal solutions do not consist of glue-like or gelatinous substances, but the most diverse substances can be brought into colloidal solution; the writer has in his possession a colloidal solution of silver, a metal which ordinarily is insoluble in water—which was made about twelve years ago, and there is no sign of any silver settling out as a sediment. The solution is an opalescent liquid of a high reddish-brown colour, and is a very valuable preparation in medicine.

From what has now been said it will be understood that colloidal clay is clay in such a fine state of diversion that when mixed with water under certain conditions it forms a colloidal solution, that is, the clay remains in colloidal suspension and does not settle out; moreover, in straining the solution through blotting paper it passes through unchanged.

There are many other properties of colloidal solutions which differ from those of true solutions, but it is not necessary in this article to go further into these; the main property to note is that in the colloidal state the substance consists of very minute particles varying in size from ·000004 inch to ·000000004 inch), whilst in true solutions the particles are much larger.

Colloidal clay is manufactured from China Clay by a process patented in all the principal countries, and its properties render it valuable in many industries; in fact, one is understating the case when it is said that colloidal clay is and will revolutionise many industries.

One of the first uses to which colloidal clay has been put is in soap manufacture. Hitherto China Clay, as such, has been used as a filling agent, but colloidal clay when incorporated into soap by a patented process, actually improves the detergent and lathering properties of the soap, as I have already shown in an article on the subject in THE CHEMICAL AGE. Soaps containing from 20 to 40 per cent. of colloidal clay are better detergents than the original soap with which the clay is incorporated. Soap is a colloidal substance, and owing to the colloidal nature of the prepared clay perfectly homogeneous mixtures of colloidal clay and soap are easily obtained, from which the clay does not separate when dissolved in water. I have just concluded a further research in colloidal clay and soap, which when published cannot fail to convince the most sceptical, and to settle the question of the use of this clay in soap.

Another very important use of colloidal clay is in the "striking" of dyes and colours. As is common knowledge the shortage of dyes, especially aniline dyes, is of national importance. When these dyes are deposited on a base the resulting pigments are useful for paints, enamels, etc., and any economy that can be effected by this method of preparation is of great value. By its properties colloidal clay is capable of effecting a great saving as a base not only in requiring less dye than other bases, but also in producing colours possessing greater staining power than has hitherto been obtainable. In lithographic inks and enamel paints a veritable revolution has been effected. It is obvious that the finer the state of diversion of a pigment and the greater its emulsification properties are so will the texture of the paint be smoother and the final appearance of the work better.

The uses of colloidal clay in the oil industry are many and varied, and its employment as a catalyst in the production of hardened fat, for example, margarine, has just been disclosed to the world.

Many other uses have already been found for colloidal clay which are of world-wide importance, but what has not been stated so far is that by the use of colloidal clay the cost of manufacture in many industries will be greatly reduced.

Hitherto the use of China Clay, as such, has been that of an adulterant or filler, whilst to-day colloidal clay is being used for entirely new purposes as an active principle, and that the world will be the richer by the discovery of this colloidal clay is open to no shadow of a doubt.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that occur.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

DORIC CHINA CO., LTD., Fenton.—Registered May 22, £4,000 (not ex.) debentures, etc., to S. A. Green, Newcastle-under-Lyme, china manufacturer, and another; charged on Doric China Works, China Street, Fenton, also general charge. *Nil. February 18, 1924.

DORSET ART POTTERY, LTD., Poole.—Registered May 13, £900 second debentures; general charge. *£1,550. December 14, 1923.

NEW NORTHFLEET PAPER MILLS, LTD.—Registered May 10, £100,000 mort., to bank; charged on Northfleet Paper Mills, Swanscombe and Northfleet, etc., and Linwood, 23, Old Road West, Gravesend, also general charge.

POINTER (HORACE T.), LTD., London, S.E., paper manufacturers.—Registered May 22, £100 B debentures, to G. H. Wilkinson, the younger, 2, Stanley Avenue, Beckenham; general charge.

TREMLETT (FREDK.) AND CO., LTD., Stoke Canon, paper manufacturers.—Registered May 29, 10,000 debentures; general charge. *£12,000. May 12, 1923.

Satisfaction

REED (ALBERT E.) AND CO. (NEWFOUNDLAND), LTD., London, E.C., paper manufacturers.—Satisfaction registered May 8, balance outstanding of £150,000, registered July 25, 1912, and January 20, 1913.

Shipping and Export News of the Month

We give below the latest particulars relating to arrivals and sailings of ships engaged in the China Clay trade, at the principal British clay ports. Registered exports of China Clay with countries of destination, and other shipping and export matters are dealt with.

Fowey Shipping—May, 1924

Arrived.	Name.	Sailed.	Destination.
May 1, S.S.	*Ferndene*	May 6,	Pasages & Bilbao
May 1, S.S.	*Brookside*	May 3,	Pasages
May 2, M.S.	*Laanemaa*	May 7,	Sarpsborg
May 2, M.V.	*Albert Mou*	May 7,	Odense
May 2, M.V.	*Martha Delphs*	May 7,	Hamburg
May 3, S.S.	*Cervantes*	May 9,	Genoa
May 3, M.S.	*Vera*	May 8,	Gothenburg
May 3,	*Cathrine*	May 15,	Helsingfors
May 4, S.S.	*Zaanstroom*	May 9,	Amsterdam
May 5,	*Irish Minstrel*	May 27,	Boness
May 5, S.S.	*Holland Maru*	May 22,	Boston, U.S.A.
May 7, S.S.	*Rubfred*	May 13,	Munkedal & Oscarshamn
May 7, S.S.	*Mersey*	May 10,	Ridham
May 8, S.S.	*Isabelatta*	May 10,	Larne
May 8, S.S.	*Caster*	May 14,	Antwerp
May 9, M.V.	*Wietze*	May 15,	Copenhagen
May 9,	*Helena Anna*	June 3,	Leith
May 11, S.S.	*Elvington*	May 17,	Antwerp
May 11, S.S.	*Florentino*	May 17,	Genoa
May 11, S.S.	*Spar*	May 24,	Philadelphia
May 12, S.S.	*Rivelin*	May 19,	Gravesend
May 12, M.V.	*Hunte*	May 17,	Leith
May 12,	*Eliane*	May 14,	Charlestown
May 12, S.S.	*Brier Rose*	May 15,	Manchester
May 13, S.S.	*Falmouth Castle*	May 15,	Runcorn
May 13, S.S.	*Overton*	May 15,	Ridham
May 14, S.S.	*Evelyn Manor*	May 14,	Par
May 14, S.S.	*Clara Monks*	May 17,	Preston
May 14,	*Amanda*		*
May 15, S.S.	*Leaside*	May 21,	Rouen
May 16, S.S.	*Vilvorde Maritime*	May 22,	Brussels
May 16, M.V.	*Jupiter*	May 21,	Stockholm
May 17, M.V.	*Lynnetten*	May 13,	Helsingfors
May 18, S.S.	*Amfred*	May 22,	Norrköping
May 18,	*Olive Branch*	June 3,	Weston Point
May 18, M.V.	*Agnes Craig*	May 26,	Rouen
May 18, S.S.	*Spain Maru*	June 2,	Portland, Me.
May 18, S.S.	*Sarnia*	May 24,	Pasages
May 18,	*Hilda*	June 3,	Tayport
May 19, M.S.	*Montan*	May 23,	Harburg
May 19, S.S.	*Cromwell*	May 24,	Preston
May 20, M.V.	*Linton*	May 26,	Rouen
May 20, S.S.	*Kentish Coast*	May 23,	Liverpool
May 20, S.S.	*Taycraig*	May 24,	Antwerp
May 21, S.S.	*Elidir*	May 23,	Barrow
May 22,	*Marie Edmee*	May 24,	Genoa
May 22, S.S.	*Beeston*	May 27,	Aberdeen
May 23,	*La Seine*	May 27,	Terneuzen
May 23, S.S.	*Ualan*	May 30,	Ridham
May 24, S.S.	*Marena*	May 27,	Bristol
May 24, M.V.	*Earl Cairns*		*
May 24, S.S.	*Falmouth Castle*	May 28,	Runcorn
May 25, S.S.	*Greta*	May 27,	Gefle
May 25, S.S.	*Chifuku Maru*	June 11,	Philadelphia
May 25, S.S.	*Broadgreen*	May 28,	Brussels
May 25,	*Elise*	June 1,	Montlauto & Rafso
May 25, S.S.	*Blush Rose*	May 28,	Hull
May 26, S.S.	*Ciscar*	May 31,	Genoa
May 28,	*Leonard Piper*	June 5,	Rochester
May 28, S.S.	*Polly Bridge*	May 31,	Preston
May 28, S.S.	*Clara Monks*	May 31,	Preston
May 29, S.S.	*Bruxelles Maritime*	June 4,	Brussels
May 29,	*Martha*		*
May 29, M.V.	*Drogden*	June 2,	Stettin
May 29, S.S.	*Guelder Rose*	May 31,	Grimsby
May 29,	*Jane Slade*		*
May 30, S.S.	*Hontestroom*	June 4,	Amsterdam
May 30, S.S.	*Orenie*	June 4,	Ridham
May 30, S.S.	*Coniston*	June 4,	Rouen
May 31,	*Britannia*	June 7,	Montlauto
May 31, S.S.	*Dorrien Rose*	June 4,	Rouen
May 31, M.V.	*Clarita*		*
May 31,	*Raymond*		*

Par Harbour Shipping—May, 1924

Arrivals

Date.	Vessel.	From
May 1, S.V.	*Fanny Crossfield*	London
May 1, S.V.	*My Lady*	Falmouth
May 2, S.V.	*Rosina*	Porthoustock
May 3, S.S.	*Norrix*	Truro
May 4, M.S.	*Lee—Lee*	Antwerp
May 5, S.V.	*John Sims*	Cardiff
May 6, S.V.	*James Postlethwaite*	Avonmouth
May 6, M.V.	*May Blossom*	Porthoustock
May 8, S.V.	*J.N.R.*	Plymouth
May 8, M.V.	*Isabella*	Porthoustock
May 11, S.S.	*Robrix*	Hull
May 14, S.S.	*Evelyn Manor*	Fowey
May 15, M.V.	*Isabel*	Porthoustock
May 15, S.S.	*Glencregagh*	St. Mary's, Scilly Isles
May 15, M.V.	*Diolinda*	Plymouth
May 15, S.V.	*Triumph*	Porthoustock
May 15, S.V.	*Emily Warbrick*	Falmouth
May 16, S.V.	*Snowflake*	Runcorn
May 16, S.V.	*Mount Blainy*	Teignmouth
May 19, S.S.	*Coniston*	Feint
May 21, S.S.	*Coniscrag*	Swansea
May 22, S.V.	*Lady Agnes*	Porthoustock
May 23, S.V.	*Sunshine*	Porthoustock
May 24, S.S.	*Ethel*	Barry
May 25, S.V.	*Alert*	Falmouth
May 25, S.V.	*Flower O' Portsoy*	Falmouth
May 27, M.V.	*Diolinda*	Penryn
May 28, S.V.	*Regina*	Plymouth
May 27, S.S.	*Magrix*	Hull
May 29, S.V.	*Guiding Star*	Port Mavis
May 29, S.V.	*Duchess*	Mevagissey
May 31, S.V.	*Hero*	—

Sailings

Date.	Vessel.	Destination.
May 1, S.V.	*Henrietta*	London
May 1, S.S.	*Norrix*	Truro
May 2, M.V.	*Maryse*	Brussels
May 2, S.S.	*Castlerock*	Penarth
May 6, S.V.	*My Lady*	Antwerp
May 6, S.S.	*Norrix*	Gravesend
May 7, M.V.	*Hetty*	Pentewan
May 9, S.V.	*James Postlethwaite*	Plymouth
May 12, M.V.	*May Blossom*	Plymouth
May 12, S.V.	*J.N.R.*	Pentewan
May 13, S.S.	*Robrix*	Charlestown
May 14, M.S.	*Lee—Lee*	Antwerp
May 17, S.V.	*Isabella*	Runcorn
May 18, S.S.	*Evelyn Manor*	Leith
May 18, S.S.	*Glencregagh*	Liverpool
May 18, M.V.	*Diolinda*	Plymouth
May 21, S.V.	*Emily Warbrick*	Runcorn
May 22, S.S.	*Coniston*	Rouen
May 23, S.S.	*Coniscrag*	Fleetwood
May 24, S.V.	*Snowflake*	Runcorn
May 27, S.V.	*Sunshine*	London
May 29, S.S.	*Ethel*	Penarth
May 29, S.V.	*Regina*	Pentewan
May 29, S.S.	*Magrix*	Charlestown
May 31, S.V.	*Alert*	Western Point
May 31, S.V.	*Flower O' Portsoy*	Bristol

Charlestown Shipping—May, 1924

Arrivals

Date.	Vessel.	From.
May 3	*Caria*	Swansea
May 7	*Ada*	Truro
May 7	*Weser*	Fowey
May 13	*Robrix*	Par
May 14	*Ryelands*	Penzance
May 14	*Cargan*	Plymouth
May 14	*Elaine*	Fowey
May 14	*Millocrat*	Penryn
May 20	*Thames*	Rochester
May 25	*Naiden*	Gweek
May 26	*N. F. Nielsen*	Gweek
May 27	*Lady Daphne*	Torquay

May 28	*Elsie Thomas*	Poole
May 29	*Magrix*	Par
May 30	*Madeleine*	Cardiff

Sailings

Date	Vessel.	Destination.
May 5	*Caria*	Barrow
May 10	*Weser*	Antwerp
May 15	*Robrix*	London
May 16	*Ada*	Runcorn
May 16	*Millocrat*	Preston
May 17	*Cargan*	Runcorn
May 17	*Louistic*	Nantes
May 18	*Elaine*	Boulogne
May 19	*Ryelands*	London
May 29	*Naiden*	Torpoint
May 29	*N. F. Nielsen*	Granton
May 29	*Elsie Thomas*	Preston
May 31	*Lady Daphne*	Rochester
May 31	*Magrix*	Rochester

Penzance Sailings

Date.	Vessel.	Destination.
May 10	*Dunleath*	Preston
May 25	*Glenreagh*	Liverpool

Par Harbour Tide Table, June, 1924

(British Summer Time Throughout.)

Day of Week.	Day of Month.	Morning.	Afternoon.	Height.
SUNDAY	1	5.37	5.57	12. 1
Monday	2	6.16	6.33	12. 2
Tuesday	3	6.51	7. 8	12. 2
Wednesday	4	7.26	7.41	12. 2
Thursday	5	7.57	8.13	11. 9
Friday	6	8.28	8.47	11. 4
Saturday	7	9. 5	9.22	10. 9
SUNDAY	8	9.39	10. 0	10. 2
Monday	9	10.22	10.48	10. 0
Tuesday	10	11.13	11.43	9.11
Wednesday	11	—	0.14	10. 0
Thursday	12	0.49	1.24	10. 6
Friday	13	1.56	2.30	11. 2
Saturday	14	3. 3	3.36	12. 0
SUNDAY	15	4. 7	4.35	12. 9
Monday	16	5. 2	5.30	13. 4
Tuesday	17	5.59	6.26	13. 8
Wednesday	18	6.53	7.18	13. 7
Thursday	19	7.43	8. 5	13. 4
Friday	20	8.28	8.53	12. 9
Saturday	21	9.17	9.40	11.11
SUNDAY	22	10. 2	10.25	11. 4
Monday	23	10.50	11.14	10. 9
Tuesday	24	11.40	—	10. 4
Wednesday	25	0.09	0.30	10. 2
Thursday	26	1.13	1.46	10. 2
Friday	27	2.18	2.51	10. 5
Saturday	28	3.22	3.50	10. 9
SUNDAY	29	4.18	4.43	11. 3
Monday	30	5. 6	5.27	11. 7

H. L. VICKARY, Harbour Master.

May China Clay Deliveries

THE deliveries of China Clay and stone in May reached the record monthly total for the year of 84,370 tons. The highest monthly total of 84,774 tons last year was in the same month, but included ball clay shipments which are not included in this year's monthly totals. Therefore China Clay and stone deliveries in May this year creates not only a monthly record, but a post-war record.

The figures for the five months of this year are equally gratifying, having reached a total of 353,974 tons against 352,010 tons, this year's total being better than the nearly 2,000 tons the difference in the figures represents, because the Devon ball clay deliveries through China Clay ports were included in last year's figures and are excluded from this year's.

The shipment of 206 of the 466 tons from Penzance is noteworthy from the fact that it was the first shipment made by the Porthia China Clay Works, near St. Ives, whose intended use of the port of St. Ives was objected to by the people of that locality.

The channels through which May deliveries were made are :-

Port.	Tons.
Fowey (including 2,130 tons china stone) ..	69,544
Par (including 1,178 tons china stone)	5,082
Charlestown	3,374
Plymouth	664
Penzance	466
By rail throughout.....	5,240
Total tonnage	84,370

In addition, 2,589 and 303 tons of ball clay were shipped through Fowey and Plymouth respectively.

A RETURN showing the registered imports of China Clay, including China Stone, into Great Britain and Northern Ireland from the several countries of consignment, during the month of April, 1924 :

Country whence Consigned.	Quantity. Tons.	Value. £
Channel Islands and total.....	190	285

China Clay Exports

RETURN showing the exports of China Clay, the produce or manufacture of the United Kingdom, from the United Kingdom, to each country of destination, registered during the month ended May 31, 1924 :—

COUNTRY OF DESTINATION.	QUANTITY. Tons.	VALUE. £
Finland	864	2,230
Sweden	3,237	7,693
Norway	2,228	3,850
Denmark	629	1,620
Germany	851	2,204
Netherlands	3,565	8,596
Belgium	5,179	10,368
France	2,584	5817
French West Africa	—	1
Portugal	5	21
Spain	2,127	7,012
Spanish ports in N. Africa	45	106
Italy	2,245	6,732
China	10	82
United States of America	48,855	117,568
Cuba	5	52
Mexico	139	598
Chile	4	15
Brazil	2	10
Uruguay	1	4
Irish Free State	35	195
Natal	—	1
Transvaal	1	4
Bombay via other ports	1,025	4,098
Madras	51	221
Bengal	350	1,400
Victoria	26	127
New South Wales	31	239
Canada	446	1,187
	74,540	182,051
Deduct to correct April published figures..	102	5,052
	74,438	176,999

Mechanics in China Clay Works

The Advantages of the Ropeway

IN the course of a report by China Clay producers on the usefulness of the ropeway transport system in its application to China Clay mining, it is stated that the system offers the following advantages :

1. If adopted at the outset when opening a new works it enables sand and burden to be dumped at any desired distance from the pit, whereas the present system of inclined tramway practically necessitates sand and burden being dumped on the very edge of the pit in order to form the tramway bank, thereby in many cases covering up valuable clay.

2. The maximum power required to drive a ropeway, being continuously applied, is less than half that required to do the same work on the tramway system, hence a considerable save in capital and maintenance cost of power for haulage.

3. Material can be transported from the side of the pit remote from the dump direct to the dump over a long span of rope, a great advantage over the tramway system.

4. The ropeway system would appear to be most suitable for carrying clay from dries to the railway and for carrying back coal and stores to the dries, as it is in carrying over long distances that the economy of the system is most pronounced.

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor, THE CHEMICAL AGE, *8, Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

Our Monthly Metallurgical Section

ALTHOUGH the Age of Chemistry is of more recent date than either the Golden Age or the Iron Age it is so inseparably connected with the latter that little or no apology or explanation is needed for the issue of a Metallurgical Section to THE CHEMICAL AGE. Metallurgy depends upon chemistry, and the metallurgical industries are but specialised branches of chemical industry, each subserving one another's needs and depending intimately on the same general body of chemical law. The objects which metallurgy sets before itself are the extraction of metals from their ores, but its processes are necessarily accompanied by the production of by-products, and it has occasionally happened that in the course of time, some of the by-products have come to be regarded as having a value little, if any, inferior to that of the primary product. The blast furnace designed for the manufacture of pig iron is, for example, incidentally a power gas producer of unusually high efficiency, while the slag which results from the smelting of the ores can be made into excellent cement. The manufacture of coke for metallurgical purposes is at the same time accompanied by the production of coal tars, liquid hydrocarbons and gases from which may be derived not only power but the raw materials of the dye industry, and of the manufacture of fine chemicals. A self-contained ironworks possessing its own coke batteries, blast furnaces, steelworks, and rolling mills is thus, and in addition, a potential chemical plant which, with comparatively little further outlay or modification, can employ its by-products for the manufacture of ammonia, of mineral acids, of motor fuels, and of chemical manures under circumstances of exceptional economic advantage. These by-products of the metallurgical operations incidental to the making of iron and steel are daily becoming of greater importance, and are being more and more generally recognised as constituting a natural branch of chemical industry. By the publication of a monthly section devoted to these aspects of a sister industry, THE CHEMICAL AGE is but acting in accordance with its general policy, which is to cover as widely as possible the whole of the interests to the furtherance of which it is devoted.

Contributions on Original Work

THE METALLURGICAL SECTION will appear monthly, and one of its features will be the publication of an original article by some recognised authority on the iron, steel, and allied trades. It is hoped by these means to disarm, to some extent, a criticism often levied against the technical press of this country that it publishes too little new and original matter. Such a criticism, we hope, could hardly be sustained against THE CHEMICAL AGE, which has always made a feature of such articles. On the other hand, it is undoubtedly true that in the technical press of France, Belgium, Germany, and Italy there is often to be found a wealth of material specially contributed to its pages by the leading experts of those countries. The explanation may possibly be in the fact that, in this country, the bulk of original research is presented by its authors before one or other of the numerous technical and scientific institutions which abound in Great Britain to perhaps a greater extent than in other countries. As such communications are eventually published in the proceedings and journals of the institutions in question, the field for original contributions to the press is correspondingly narrowed.

Steel and Iron Manufacture

IN THE ARTICLE by Mr. Fred Clements, which appears in this issue, reference is made to the necessity of securing uniformity in the size and physical condition of the materials used in the blast-furnace burden. Mr. Clements is an acknowledged expert in blast-furnace and steel works practice, and it is therefore of deep interest to manufacturers to have his endorsement of the value of grading. Uniformity as regards ore, fluxes, fuel, and air constitutes one of the chief factors in effecting fuel economy and in increasing the efficiency and steady running of a blast-furnace. Unfortunately, information is lacking in regard to the cost of such grading. It must obviously vary greatly at different works, but no comparative data have yet become available as to even the cost at any given works. Grading must inevitably increase costs to a certain extent, and such economies as are effected will be indirect, and must amount to more than the extra expenditure involved, in order to justify the latter. Just what these respective amounts are it has hitherto been difficult to ascertain, although they are probably known to not a few managers who have had experience of grading the ores they use. It is to be hoped that some will be sufficiently public-spirited to publish the results obtained, and so furnish a definite lead as to the advantages and disadvantages they have experienced.

Oxygen and the Blast Furnace

THE revolutionary developments which would be made immediately possible by the discovery of a means for producing cheap oxygen are only too well appreciated by the industrial chemist, but they must surely be even more apparent to the practical metallurgist. In the production of one ton of pig iron it is probably necessary to pass through the blast furnace about three tons of diluent nitrogen, a procedure which involves serious thermal and metal losses. The elimination of such losses by the substitution of oxygen, or a mixture of oxygen and air, has long been considered, but has not been put into practice on account of the inability to produce oxygen in quantities at sufficiently low cost to make such application industrially possible. That active American organisation, the Bureau of Mines, has been hot on the path of the opportunities offered by the use of oxygen, and has made a thorough survey of the existing processes for the manufacture of 99 per cent. oxygen, and finds that the oxygen industry is now able to make plants for supplying large quantities of oxygen to metallurgical industries at low cost. Plans have been developed for experimentally determining the effects of oxygen-enriched air upon the operation of the blast furnace, and it has been recommended that these plans be put into effect as the first step in an extended research as to the general applicability of oxygen to metallurgy. The knowledge that German industrial concerns are working actively on the application of oxygenated air to metallurgical processes has greatly concerned American iron and steel interests, and the industry is making insistent demands for research work of this nature.

Probable Developments in the Manufacture of Iron and Steel

By Fred Clements, M.Inst.C.E., M.I.Mech.E.

In a topical article, the writer, whose knowledge of technical conditions is well known, points in the main to the directions in which future developments in blast furnace practice are likely to move.

In spite of the unprecedented depression from which the Iron and Steel trade has been suffering during the last two years, the importance of this industry in its relation to the world's economics is undiminished. Indeed, due to the growth in the application of steel to new purposes during the war, there is every possibility of still greater demands being made for this increasingly useful material. The present position, although serious, can only be deemed to be artificial, and is due to a variety of causes which will in the course of time pass away, as, for instance, the situation on the Continent and the disparity in exchange, and with the disappearance of the abnormal conditions the industry will become stabilised on a new economic level. This level, however, cannot be identical with that existing in pre-war days because some of the factors which help to determine it are permanently altered as a result of the disturbing period through which we have passed.

There is no need for undue pessimism in the outlook for the iron and steel industry, although it has to be clearly recognised that only those plants which are able to produce material with the utmost economy will be able to operate successfully, even when stable conditions have been reached. For this reason it may not be out of place in this first number of a new issue, which is intended to deal with the problems of iron and steel manufacture in a definitely practical fashion, to review the present situation as far as production is concerned, and to try and estimate what the future developments may be. There have been no epoch making discoveries during the last ten years which are likely to form the basis of an entire revolution in iron and steel works practice, rather the trend has been one of gradual development as a result of research, experiment, and experience. It has been increasingly recognised that, in order to meet the circumstances, higher all-round efficiency of manufacture must be attained, and to this end, both in the production of iron and steel, there has been a marked movement towards increase in output per unit of plant. Again, the application of labour-saving devices has been widely extended in order to render these higher outputs possible. The question of fuel economy has also become one of first importance, and much time has been given to investigating the fundamental principles of iron and steel manufacture in order to discover how the thermal efficiency of both the blast furnace and the Siemens O.H. furnace can be improved.

Larger Blast Furnaces

It is along the lines indicated that the future developments are likely to come. With regard to the production of pig iron, larger outputs will demand larger furnaces, and whilst in the past the size of a blast furnace has been deemed in this country to be distinctly limited, yet the experience which has been gained by bold revisions in design leads to the conclusion that the limitations referred to only exist in the imagination and not in fact. American experience has all tended towards the use of the big furnace, and the increase in the hearth dimensions and alterations in furnace lines which have been tried in this country go to indicate the advantages which would follow development on these lines.

It is, of course, self-evident that in order to have satisfactory operation in a large capacity blast furnace all the conditions must be favourable towards free and regular running. In this connection there must be closer attention given to the question of breaking and grading the ore. American practice in this respect, especially in the northern area of the United States, is helped by the natural condition of the Mesabi Ore, which is uniformly in the nature of sand. In the Alabama area, however, the ore more nearly approaches the character of the Lincolnshire deposits, but the practice is to break the whole of it into pieces of about 2 in. to 3 in. cube. This practice will eventually be followed in Great Britain, when the advantage of the furnace with the big hearth and steep bosh is fully realised, because it is only in furnaces of this design that the full advantage of a uniform burden and rapid working is obtained. In furnaces where several classes of ore are used the development will be towards grading the broken ores not only in size, but also in accordance with their analyses, so that it will be possible for the furnace manager to burden his furnace with materials of known characteristics, so ensuring still more the regular working of the furnace. As far as coke is concerned the fragile character of much of that produced in this country precludes any idea of crushing it. In those areas where hard coke is produced an advantage would follow from breaking it into pieces of regular size. The fines should be separated from all coke used for blast furnace work, because these usually contain deleterious matter which it is a benefit to keep out of the furnace.

Breaking and Grading

The breaking of the ores and grading of the coke as outlined above will not only give a furnace burden capable of regular working, due to the elimination of the large lumps, which is often a feature of British practice to-day, but will also give conditions in the furnace which will offer greater resistance to the passage of the gases, and consequently higher blast pressures will have to be adopted. The pressure of the blast is really a measure of the resistance of the burden, and has no influence upon the rate at which the furnace works, apart from providing the motive force sufficient to cause the flow of the gases through the burden at the necessary speed. The rate of working depends entirely upon the weight of the oxygen, and consequently of air, which is forced into the furnace per unit of time. The method of providing the blast has passed through several stages of experience, and whilst the reciprocating steam blowing engine is still widely used, the need for increasing efficiency has led to the adoption of the reciprocating gas engine and also of the turbo-blower. The early gas engines, due to want of experience on the part of the builders, were not eminently satisfactory, and consequently the turbo-blower has been adopted in many plants in preference to the gas engine. Great strides, however, have been made in the development of the gas-driven machine, and there is now a tendency towards the adoption of this type of blowing plant in preference to the turbo-blower. The latest designs of the best builders leave little to be desired, either in efficiency in working, reliability, or capacity, and the much greater thermal efficiency of the gas blowing engine as compared even with the steam turbine will render it in future almost without a rival for this service. There will be a great development in the more economical use of blast furnace gas. The whole of the gas on up-to-date plants will have to be cleaned, and the design of the stoves will be such as to use the minimum amount of gas for heating the blast. This will leave at least 60 per cent. of the total gas produced available for blowing engines and for the production of power. Blast furnace plants, therefore, with the adoption of large gas driven generating units, will become centres of power production from which either the local authorities can be supplied, or the energy applied in the steelworks if the blast furnaces form part of a composite plant.

In considering furnaces of the type indicated as the possible development of the future, the means for handling the raw material will have to be entirely revised. Mechanical handling will have to be introduced, not only to reduce the labour to a minimum, but as the only means by which rapid driving furnaces can be kept full.

Experiments are being made in several directions with plants designed for the direct reduction of iron ore. These have met with varying success, but none can be deemed as yet to be a commercial proposition. It has been proved, however, that a measure of success attends such efforts, and a prospect of solution cannot be ignored in any consideration of future developments.

Larger Siemens Furnaces

Reverting now to the question of developments in steel manufacture, the most noteworthy point is the considerable increase in the production of steel by the Basic Open Hearth process, which has taken place over the last ten years. This is largely due to the exigencies of war conditions, which compelled manufacturers to turn their attention to the utilisation of our home resources, and consequently the phosphoric ores of which there are large quantities available were utilised by a wider adoption of the basic process. With proper working in the Siemens furnace it is now possible to produce Basic Open Hearth Steel which in all characteristics, chemical, physical, and microscopical, is indistinguishable from Acid Open Hearth Steel made for the same purpose. From some points of view, however, basic steel for general purposes has features superior to the acid material.

The general tendency has been towards the use of furnaces of larger capacities, and whereas 20 years ago furnaces dealing with a charge of 30 tons were deemed large, yet to-day many firms are operating units of 60 tons capacity and in some cases as much as 80 tons. Even these large furnaces cannot be said to mark the limit of capacity, because there is a decided increase in general efficiency by an increase in the weight of material which can be dealt with per charge, and the whole object of metallurgical development is towards a reduction in working costs. With the introduction of the larger furnace there has been a number of problems introduced, amongst them being the need for rapid melting of the initial charge. To this end much work has been done to improve the combustion of the gas and air when introduced into the furnace, but other efforts along these lines will have to be made before the best conditions are found. Closely linked with the question of combustion is that of regenerator design, since the proper regeneration of the gas and air has such an important bearing on the question of fuel economy. This latter question has received considerable attention of late years, and active efforts have been made with success amongst some firms towards improving the general character of their Siemens furnace practice and also of their gas producer practice, which has led to a marked improvement in the fuel consumption per ton of steel made.

Electric Furnaces

Consequent upon the demands for special alloy steels for automobile work the manipulative advantages of the electric furnaces have been recognised, and the tonnage produced by this means has rapidly increased. The chief features which render the modern electric furnace an attractive producing unit are the easy control of the temperature of the bath, the ability for special refining of the steel in regard to the elimination of impurities, and the accuracy with which a desired composition of steel can be produced. There are several successful designs of furnaces at work, all of the arc type, but even the best can only be deemed to represent a step towards the final type. There has been rapid development, not only in improvement in details, but also in furnace capacity. In this country furnaces capable of dealing with 10 tons per charge are about the maximum, but in Sweden and Italy much larger units are in use, and in America one large automobile firm is installing a furnace of 60 tons capacity which will be shortly put into service. Despite this progress there is very little technical information available regarding the fundamental principles of the process, and there is certainly considerable haziness as to the reason for some of the results produced. Amongst the chief requirements of the electric furnace is the provision of reliable electrodes at a reasonable price. Again, there is the question of the cost of the electric energy available. These two factors are the principal influences determining the cost of the steel produced and will no doubt be the subject of investigation and practical development.

The advantages of the electric furnace as previously outlined have rendered possible to a greater degree the production of steel castings of much higher grade than hitherto possible, and a new era opens out for the application of cast steel for special purposes where previously only forgings could be used. This will result in cheaper manufacture without any sacrifice of reliability. In addition to the benefits following from the use of electric steel for castings there has been a great deal of research done in relation to the best methods of producing castings of all types. This research is still in progress, and judging from the results already obtained there are still vast possibilities for the future.

Stainless Steel Developments

It is hardly necessary to traverse the whole field of steels for special purposes, but perhaps the most striking development has been that of the 12 per cent. to 14 per cent. chromium alloy known as stainless steel. The corrosion and high temperature resisting properties of this steel, together with its excellent mechanical features, render it of the utmost value to the industries, and when its cost of manufacture has been reduced there will, no doubt, be a very much wider use made of it. It has been reported from Germany that successful attempts have been made to produce steel for ordinary structural purposes in a non-corrodible condition. This report has not been confirmed, and it is difficult to see how (in view of the high price of the alloys necessary to render the material rustless) it could be made at a price which would render it available for such purposes. It is not beyond the bounds of possibility however. In fact, it seems highly probable that before many years are past developments along these lines will take place. In view of the clearer conceptions which are now held of the functions of corrosive attack it seems certain that the consideration of the question of the rust resisting alloys is in its initial stages only. The most recent phase of this subject is revealed in the production of castings of stainless steel and also of malleable sheets of similar material for cold working.

High Speed Machining Steel

Again, the demands of the automobile industry, faced with the need of building cars at competitive prices, has led to the demand for a steel which it is possible to machine at a very high rate at the same time leaving a highly finished surface. This has been met satisfactorily by a material known as "free cutting steel," which contains a larger content of sulphur and phosphorus than is usually permissible. This steel is now being widely used for purposes other than in direct connection with motor car work, and its application in the future will be very wide since it is particularly suitable for automatic machines.

Tensile Strength

Another development which has received considerable attention and the solution of which cannot now be long delayed, is that of the production of a steel which will have a much higher tensile strength than the normal qualities. This is rendered necessary by the development of the all-steel built aeroplane, and the future of this type of machine certainly lies along these lines. Consequently, a material which would combine great reliability and strength, when in a form from which the aeroplane could be built with a minimum of weight, would go a long way towards solving the problem of the best type of flying machine.

In conclusion, it may be said that though the future of the iron and steel industry still bristles with many unsolved problems, yet the consistent progress of the industry during the past 20 years gives ground for confidence that these problems will not only be solved, but many other achievements will be attained which at the moment may only exist in the imagination of the technical man of vision. There is, therefore, despite the difficulties of the day, no ground for pessimism, but every reason for optimism in this great and important industry.

Dr. J. N. Greenwood's New Post

THE Council of the University of Melbourne has appointed Dr. J. N. Greenwood, of Stocksbridge, near Sheffield, to the Chair of Metallurgy in that University. Dr. Greenwood is the head of the research department of Samuel Fox and Co., Stocksbridge Steel Works, one of the companies in the United Steel combine. He was educated at St. Helens Municipal Technical School as an evening student, and during the day worked as an assayer in a local lead-smelting works. Later he proceeded to Manchester University, where he graduated in 1916. For some time he was in the research department of Armstrong, Whitworth and Co., and in 1919 went to Stocksbridge.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

A BLAST FURNACE, as we all know, makes pig iron, and is, incidentally, a power producer. That is to say, its direct object is accompanied by the production of an exceedingly valuable waste product. The suggestion has recently been made that a power plant might, incidentally, make pig iron. In the slagging producer we have a plant that might well subserve such a purpose. Indeed, a sort of pig iron has already been made, more or less economically, in France by such means. This is, of course, only a beginning, but the possibilities it opens up are interesting. Given a suitable charge to take the place, in a gas producer, of the blast furnace burthen, with cheap fuel and easily reducible ore, there is no intrinsic reason why a battery of well-designed slagging producers should not be regarded as a modest iron works, making a special kind of pig iron for which some use could doubtless be found, in small quantities, and as a by-product. The descent of the charge has been found, in the case quoted, to be irregular, and the wear on the linings has been unduly heavy. But a slagging producer, if ever it is to become a paying commercial proposition, must learn to slag properly as well as make a decent power gas, and while it is about it there seems no real reason why it should not function as a miniature blast furnace if it wants to.

Amalgamation or Co-operation?

ONE OF THE EVENTS of the past month has been the issue of a new edition of Harbord and Hall's invaluable textbook on *The Metallurgy of Steel*. The work has been thoroughly revised and is a credit to those concerned with the revision. A very interesting feature has been introduced at the end of the second volume. Here we have, presumably from the pen of Mr. Hall, a chapter on the Past and Future of the Steel Trade, in which a useful and well written survey is made of the conditions in the past which have made the steel trades of Great Britain, the United States, France, Belgium and Germany what they are in the present. Incidentally, it serves to show how and why British practice has selected, for the most part, to manufacture in comparatively small units and how entirely the British steel trade has in the past relied on stabilised conditions in the coal industry, and more especially on cheap coal supplies, for its development and progress. It foreshadows likewise in the changed conditions actually prevailing the necessity of British manufacturers setting their house in order, and points out many directions in which this can be done. It would appear that the author favours the amalgamation of firms and the resulting economy due to diminished overhead and other costs. The German system of cartels, however, supplies an alternative method of dealing with trade problems and avoiding undue and throat-cutting competition between rival firms. It may be that some happy mean may be found, some compromise less injurious to the home consumer than the cartel often proved to be in Germany, and at the same time conducive to co-operation amongst different firms in regard to buying and selling associations.

It is up to the National Federation of British Iron and Steel Manufacturers to evolve for the general good some large and comprehensive scheme for the betterment of industrial conditions and the solution of the commercial problems with which the iron and steel trades are faced. Much might be done by the provision of machinery for the free and open discussion of the difficulties which exist, and for opportunities for the airing of views, without the holders being thereby committed to any immediate decision or action. In an atmosphere of free discussion much of the present misunderstandings and difficulties might evaporate; manufacturers would learn to understand and to respect one another's views, and if not faced with the necessity of coming to an immediate and binding decision, could discuss the problems of the trade with less prejudice or hostility. When a formal resolution has to be come by it is difficult to take unbiassed views; the interests concerned have already a *partie prise*, and are actively for or against the proposed resolution. Opportunities for discussion, with the knowledge that no decision need then and there be taken, would at least show whether the time was ripe for action, or whether further consideration might not be advisable. The decision of a majority, forced, without adequate discussion, leaves the minority hostile and antagonised, a frame of mind fatal to successful concerted action in matters of industrial importance.

The Bessemer Process

SOME ARGUMENT has arisen lately in *Nature* as to the future of the Bessemer process. Professor Carpenter recently challenged the statement of a reviewer to the effect that the process was dying out. As usual in any controversy respecting which the ultimate verdict reposes upon statistics, there is a trap. So far as this country is concerned the process is undoubtedly falling into desuetude. The following figures bear out this fact:—

Bessemer and Open Hearth Steel Production in Great Britain

	Bessemer Steel.		O.H. Steel.	
	Acid. tons.	Basic. tons.	Acid. tons.	Basic. tons.
1913 ..	1,048,772	551,929	3,811,382	2,251,793
1922 ..	288,800	196,000	1,709,000	3,625,000

In the United States the process is more than dying out, it is, for all interests and purposes, dead. Not so, however, on the Continent. In this connection the following figures are interesting and significant:

Bessemer and Open Hearth Steel Production in France

	Bessemer Steel.		O.H. Steel.	
	Acid. tons.	Basic. tons.	Acid. tons.	Basic. tons.
1913 ..	252,704	2,806,475	1,582,478	
1922 ..	6,818	2,884,602	1,498,166	

It is a trite saying that there is nothing so misleading as statistics. From the above figures no definite conclusion can be drawn as since the war conditions on the Continent have been hopelessly abnormal. So far, however, as Continental conditions go, some light may be thrown on the subject from the fact that all the reconstruction work which has taken place in France since the devastation of her industrial centres has included the provision of a very heavy proportion of new Bessemer plant, chiefly for the manufacture of basic Bessemer steel in large converters. The French are no mean metallurgists. They have, indeed, always excelled in theory, and, considering the lack of fuel under which the French iron and steel trades have to be carried on, the practice in that country falls little short of theory. French practice favours the Bessemer process, and the same may be said of Belgium. In regard to Germany it is probable that all published statistics are doubly misleading, misleading according to the intrinsic and inherent misleadingness of statistics in general, and specifically so because little or nothing which emanates from Germany is to be believed, whether in regard to published figures as to population, output, wages, wealth, or anything else. Generalising broadly, it may be said that the Bessemer process is dying out in Great Britain and in America, but is probably progressing on the Continent, destined in the near future to be perhaps the leading centre of iron and steel production. It remains to be asked, "Why is this so?"

Good and Bad Steel

WE HAVE IT on the testimony of the manufacturers themselves—and what testimony could be more convincing and more disinterested?—that good basic Bessemer steel is as good as, and better than, any that can be produced in an open-hearth furnace. *Ex parte* statements are always suspect, but many brilliant and unbiassed metallurgists endorse this view. Bessemer steel, and in particular basic Bessemer steel, if properly made, is very good steel. It is, moreover, the cheapest steel to make, and naturally requires much less fuel. The ratio of coal consumption in the Bessemer process and in the open-hearth process is at the least generous computation as one is to two; in practice the advantage is even greater on the side of the Bessemer process. Years ago, however, bad Bessemer steel earned a bad name with engineers and users,

and since then it has in this country never succeeded in retrieving its reputation in the minds of those who can influence specifications. It is a dog with a bad name, perhaps wholly undeserved, for any badly made steel is bad steel, and the Bessemer process has been damned on the strength—or weakness—of badly made steel by this process. Hence it is falling into abeyance: and what is worse, the generation of skilled blowers upon whom its success could alone depend is dying out in this country. So in spite of the fierce competition with which we in this country will soon be faced from abroad, and in spite, likewise, of the incessant demand for fuel economy, we are abandoning the process which is most economical of all in respect to the expenditure of fuel, and with skilled experience might have been trusted to produce, engineers notwithstanding, excellent material at a low cost.

Commercially Pure Iron

MR. D. M. STRICKLAND, in a communication dealing with the part which the chemist plays in the control of commercially pure iron, states that the perfection of commercially pure Armco ingot iron is a research accomplishment—an achievement primarily designed to reduce the growing and serious expense of rust. Metallurgists and chemists pointed out the way. They experimented, studied and investigated. They analysed century old irons seeking the reason for such longevity and resistance to the natural causes of corrosion. The problem was how can the life of iron be increased, and the answer was found to be, "produce an iron free from segregated and rust-inviting impurities." To ensure exceptionally pure iron, impurities from extraneous sources must be reduced to a minimum. Only quality raw materials are permissible. The chemist must analyse the ore, limestone, dolomite, coal, coke, gas, and pig iron. He finds it necessary to investigate the analytical qualities of slag, chrome ore, spar, furnace supplies, ladel linings, sleeve bricks, scrap, refractories and all other raw products which might either directly or indirectly influence the chemical purity of the finished product. He must seek for hidden impurities—traces of foreign elements considered unimportant or totally unknown to producers of those ferrous metals for which purity and rust resistance are not essential qualifications.

During the actual manufacture of commercially pure iron the chemist never ceases his exacting analytical examinations. He must devise his own methods to ensure accurate determinations of the minute traces which may remain after the metal is poured. During the two or three extra hours the molten iron lies in the basic open hearth furnace (receiving the additional purification which has been found so essential) tests must be dipped from the fluid metal and taken to the laboratory. Not until the chemist finds the preliminary test to be of the required purity are the furnace tenders allowed to remove the iron from the furnace.

The chemist must analyse each and every pour for carbon, manganese, sulphur, phosphorus, copper and silicon. By repeated experiment he must perfect scientific degasification practices. The oxygen, hydrogen and nitrogen contents must then be accurately determined. Only when these nine impurities total less than sixteen-hundredths of one per cent. can the manufacturer market the iron as a rust-resisting product, and guarantee its purity.

Atmospheric Corrosion of Metals

A CONSIDERABLE advance in our knowledge of the phenomena of tarnishing, which forms the first apparent stage in the corrosion of metals, has been achieved by Mr. W. H. J. Vernon. His recent paper read before the Faraday Society in London is a report on work carried out for the British Non-Ferrous Metals Research Association. The object of the investigation has been to study the relative behaviour of different metals when exposed to atmospheric influences, both indoors and outside. Very briefly the results so far achieved may be indicated, but since the paper contains a mass of detailed observations, the original must be consulted by those desirous of ascertaining the full significance of the research.

In the first place the enormously greater attack of iron than of other metals is brought out, and although this side of the subject is only incidentally touched upon, its practical value to all who have to select materials for domestic or constructional purposes is obvious. The detailed study has brought out for the first time the marked difference in the mechanism of corrosion with different metals. This discovery promises to prove of the greatest importance both from a practical point of view as well as in leading to a further elucidation of the whole question of corrosion. Three different types of tarnishing have been distinguished. In the first type, represented by copper, the tarnish film actually protects the metal from further attack, the progress of tarnishing becoming slower and slower as exposure proceeds. This is accounted for by the supposed continuous layer which the tarnish film forms and the consequent difficulty the corroding constituents of the air find in reaching the underlying metal.

In a second type the tarnish is neutral and the attack proceeds steadily—for instance, zinc in a dry atmosphere; in this case it is probable that the film is previous to the air. Finally, the corrosion, whilst starting off fairly slowly may become accelerated and this forms the third type, exemplified by iron; it is suggested that here the corrosion product, rust, assists in the attack.

The author has investigated other apparently quite distinct types of film which form upon certain metals when exposed to the air. Nickel and some of its alloys at first seem not to tarnish at all, but rather to condense or produce on the surface a fog of cloudiness, which can be readily removed by simple washing with alcohol, restoring the bright metallic surface underneath. The discussion on the paper helped to emphasise the importance of a detailed laboratory study of the tarnish films themselves. Reflectivity measurements have already been applied by Mr. Vernon to determine quantitatively the progress of tarnishing. The future seems to demand a greater knowledge of the constitution and life-history, both of the friendly and of the enemy films, and it is to be hoped that the British Non-Ferrous Metals Research Association will attract the interest and support of the large body of manufacturers and users so that this can be done and the exposure tests under widely different climate conditions can also be continued.

An Advance in Metallography

THE study of the minute structure of metals and alloys under the microscope has been of such value to the science of metallurgy in the past, that it is only logical to suppose that it may be equally useful in the future. Unfortunately, in many cases a difficulty in this method arises from the fineness of the structure of specimens requiring a high degree of magnification. Photographs, the only reliable guide in exact work, are rarely taken at magnifications of over 1,500 diameters in ordinary industrial practice. In November last, however, Dr. F. Rogers in a paper read before the Sheffield Association of Metallurgists, described some work in which photographs were taken with most satisfactory results in magnifications up to 5,000 and 7,500 diameters. These were obtained rapidly and surely under normal working conditions, by a worker without any previous experience of photography. The instrument used in obtaining these results was one recently brought out by F. Davidson and Co., of Great Portland Street, London, and known as the "Davon" super microscope.

This instrument is very solidly constructed so as to be suitable for the most exacting requirements of research and industrial work. It is an adaptation of the microscope, the usual eyepiece in this instrument being replaced by a secondary objective, which is made effective by inserting between the primary and secondary objectives a special lens, known as the collector. The system as thus arranged has three lens systems, and it is in this form that it is used for photography. For visual work another eyepiece is used, making a system of four lenses, primary objective, collector, secondary, and eyepiece. The slides illustrating the lecture, which were obtained with the super microscope at low powers, $\times 100$ to $\times 500$, were remarkable for their fine definition, which was obtained without the short "working distance" required for ordinary work of this order. The magnifications of 2,500 diameters up to 7,500 diameters, though not producing such a crisp definition, nevertheless gave efficient photographs, without undue difficulty, thanks to the mechanical construction of the instrument, a result which can be truly said to be remarkable and full of possibilities.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE optimistic tone in the iron and steel trade has been maintained throughout the month of December. In many quarters there was a feeling that the General Election, with its possibility of a Protectionist Government being returned with a working majority, was the chief cause of the liveliness which had been manifested; but the "stalemate" result of the polls and the opening for a Labour Government have not caused any set-back. There was the usual lull on the approach of the Christmas holidays, but there is reason to expect that the New Year will open with renewed activity.

For the present it is no longer necessary to worry about the good or the bad effects of Protection, and with the present constitution of the House of Commons the prospect of a Capital Levy is very remote. It will be a good thing if the three political parties are fully occupied in keeping each other in order, so that industry can be left to find its own level without undue interference.

The Pig Iron Market

Business in the pig iron market has been quite good. It is evident that the improvement is not a mere spurt, but is based on a genuine revival. The export trade has not expanded, and the prospects in this direction are somewhat doubtful. The home demand has, however, increased, not only for the foundries but also for steel making. The manufacture of basic open-hearth steel has been rapidly developed since the War, and there is a call for basic pig iron. Prices all round have held firm without much alteration, although the tendency is upwards. As the steel works get busier, pig iron will be in greater demand, and the price is bound to advance, particularly if there is any renewal of the Continental inquiries.

Sufficient work is not yet being given out to warrant the starting of many additional furnaces. Accumulated stocks, however, have been largely reduced. The question of supplies of pig iron for a normal condition of trade is somewhat disturbing. There are a number of furnaces which were blown out after the 1920 boom and which will probably not start again. They are too uneconomical. There are others which cannot be started at present because of the shortage of coke. Officially the price of coke has been fixed at 24s. per ton to the end of March, 1924. The increasing call for supplies from the pig iron makers renders this price merely a nominal one, and the actual price having to be paid is one or two shillings higher. Additional supplies are difficult, if not impossible, to obtain. We know of one large works which was in a position to secure business sufficient for the blowing in of another furnace, but had to decline it because the necessary coke could not be purchased. About 300,000 tons of coke are being shipped each month, chiefly to the European countries, whilst the blast furnaces at home have trouble in obtaining supplies!

Coal Prices

Coal prices, too, are advancing, and the comparatively limited supplies give the steel maker no chance of resisting the advance. Both coal and coke are too high. It is a pity that these heavy fuel costs are there to act as a brake on the steel industry; but the demand, coupled with the lower output, prevents any reduction. The steel-making capacity of the country has largely increased compared with 1913, whilst the output of coal is actually less. Unless the output does increase we shall be faced with the alternative of working the steel plants at less than their full capacity, which does not make for economy, or of reducing the shipments of coal and coke, which also has its disadvantages.

The finished iron trade is participating in the general improvement. There has been a good demand for pig iron from the foundries to meet the prospective orders for castings which are expected in the New Year. The official price of bar iron has advanced 10s. a ton. The higher prices of small steel bars have helped the iron manufacturers, but the steel bars still hold too great a lead.

Future of the Iron Trade

The future of the iron trade is rather problematical. The difficulties of production are increasing, as it is almost impossible to replace the old puddlers when they drop out, and so far no really satisfactory method of mechanical puddling has been developed.

The steel makers have no reason to be dissatisfied with the course of events in December, notwithstanding the two adverse influences in this month, the General Election and the Christmas holidays. The upward movement in prices has continued, boiler plates having advanced to £14, ship and tank plates to £10 10s., and sections to £10 per ton, whilst in the other branches prices have remained firm, with the sole exception of soft billets, which have receded slightly. The advance in the price of these was a very sharp one, due to the rapid increase in the price of scrap. That has now fallen back a little and the price of billets has moved in sympathy, although it still stands at a much better level than it did a month or two ago.

The actual business placed has, of course, been somewhat smaller, but that is a seasonable depression due to the holidays. Most of the works have been standing for a week or a fortnight, and the orders accumulated will give a good start for January. Taken all round, prices are rapidly approaching the level at which makers can see some small return for their expenditure.

The railway orders have been the chief feature of the past few weeks. In addition to the orders for rails and constructional material which are being placed direct by the railway companies, they are giving out a number of contracts for engines, wagons, etc. to private firms. It must be pointed out, however, that the steel requirements for a large portion of this railway work have already been covered, in many cases at prices lower than those now ruling. The merchants particularly took the opportunity of covering themselves while prices were at or near the bottom, and consequently some of the work which comes through to the steel works will not be at the present more attractive prices. Still it is the volume of work that is wanted, and the greater the output the easier it is to keep costs down.

The additional wagons are badly wanted, as there is scarcely a large works which is not suffering to-day from the shortage of wagons. This disability is particularly in evidence at the collieries.

Increased Activity in Steel

So far the increased activity in the steel trade has been due to the home demand. The railway contracts, running into millions of pounds, are bound to influence the market very considerably, and they will do much to tide the industry over the period which must yet elapse before European conditions are approaching the normal. Apart from the particular Japanese business resulting from the earthquake disaster, there has been no corresponding animation in the export trade, and from that side the future is not so bright. There seems to be at last some prospect of an understanding between France and Germany, industrially, if not politically. The recent French agreement with the Ruhr Industrialists is of considerable importance to the steel trade here. The outcome of it may well be that not only France and Belgium, but Germany herself, will come into more active competition in the export market, Germany in particular being aided by the low wages and longer working hours which the owners are now forcing on to the workers, who seem to have no choice but to work for what they can get, or to starve.

It is therefore more than ever essential that the British steel makers should not be satisfied with obtaining higher prices, but should make every effort to reduce costs; for, after all, it is the bringing down of production costs that will best serve the industry. The scope for this economy is not in wages, which, generally speaking, are low enough, but in efficiency in the works—or in the want of it. There is still a lot of ground to regain there, although some recovery has been made from

the wasteful habits acquired during the War and the following boom. It is far healthier to secure profits by eliminating unnecessary expenses in production than by asking high prices to cover these expenses.

Belgium as a Competitor

BELGIUM is likely to be a very dangerous competitor; she has rebuilt and modernised most of her works since the War, and has reached practically the pre-War output. Already the Belgian works are taking advantage of the higher English prices, and are offering steel at prices that make it difficult for the English works to hold them off, particularly in billets.

The iron and steel manufacturers are not sorry to see the end of the year 1923. It has been a harassing time and has shaken the joints of many soundly constructed concerns. The reports and balance sheets of the large companies which have appeared from time to time have made clear what a strain has been put upon them. The unemployment figures have been a cause of anxiety, which was deepened by the probability of still larger numbers being out of work at the year end. It was wise counsel which led the Government and the railway companies to launch their programmes of new work before the close of the year. It has enabled the steel makers to abandon the low prices which had hitherto been ruling; and consumers now realise that it is no use holding back work in the hope of reductions.

It must not be overlooked that to a large extent the work now being placed represents the accumulated arrears of past years, and therefore cannot be taken as the measure of a broadening of the general trade demand. Nevertheless, it is work on which the steel trade relies in normal times for a substantial share of the orders necessary to carry on, and it stimulates the flow of trade from other quarters. Above all, it helps to restore that feeling of confidence which is so necessary to any real revival in trade, and which has been so sadly wanting during the year that has just ended.

New Metalliferous Mines Committee

THE Advisory Committee for the Metalliferous Mining Industry, appointed in accordance with the provisions of section 4 of the Mining Industry Act, 1920, has been reconstituted with the following *personnel*:—

Mr. J. J. Burton, J.P., chairman; Mr. William Walter Casson, Mr. D. F. Gill, Mr. S. J. Lloyd, J.P., Mr. Claud Edward Pease, J.P., and Mr. R. E. Westwood, J.P., representatives of owners of iron ore mines and quarries; Mr. Harry Dack, J.P., Mr. T. Gavan-Duffy, M.P., Mr. Henry Nixon, J.P., Mr. James Pickavance, and Mr. Will Sherwood, representatives of workers in or about iron ore mines and quarries; Mr. R. Arthur Thomas, representing owners of tin mines; Mr. Joseph Harris, representing workers in or about tin mines; Mr. Anthony Wilson, J.P., representing owners of lead and zinc mines; Mr. James Wignall, M.P., representing workers in or about lead and zinc mines; Mr. Frederick H. Hatch, Ph.D., O.B.E., Professor Henry Louis, D.Sc., and Mr. Frank Merricks, C.B.E., economic geologists and mining engineers; Mr. Frank William Harbord, C.B.E., metallurgist; Mr. Clive Cookson, representing the non-ferrous metal trade, and Sir Kenneth Weldon Goadby, K.B.E., representing medical science. Mr. F. C. Starling, of the Mines Department, acts as Secretary to the Committee.

"Chartered Civil Engineer"

AN important alteration in the by-laws of the Institution of Civil Engineers has been approved by the Privy Council. The new enactment grants to members of the Institution, the right to describe themselves as "Chartered Civil Engineers." The qualifications demanded by the Institute for admission have been adjusted in accordance with modern engineering and scientific developments, with the object of raising the standard of qualifications for corporate membership. While the unregulated use of the appellation "Civil Engineer" has deprived that title of professional significance, the designation of corporate membership of the Institution ("M.Inst.C.E." or "Assoc.M.Inst.C.E.") is recognised as an authoritative mark of professional competence. Nevertheless, the mere designation of membership of a Society has not in recent years been found to convey that definite idea of professional status to which the public is accustomed. The introduction of the title "Chartered Civil Engineer," therefore, marks an important stage in the long history of the Institution.

Some Inventions of the Month

By Our Patents Correspondent

Preparation of Ores for Leaching

A PROCESS to facilitate the recovery of metals such as gold and silver from ores has been invented by C. Hennes of Berlin. The ore is placed in a solution of saltpetre containing 15–30 parts by weight of saltpetre in 100 parts of water without any preliminary treatment. A small quantity of catalyst, such as sodium chloride, calcium chloride, iron chloride, sulphuric acid, iron sulphate, etc., may be added, and the mixture heated to 80°–100° C. It is found that after this treatment the silver is readily soluble in hyposulphite lye, and a yield of 95 per cent. may be obtained. The solution of saltpetre may be used several times over, since the consumption is only about 1·5 per cent. of the amount of ore treated, and the used solution is found to be more active than a fresh solution.

A somewhat similar principle is involved in another process, in which the ore or metallurgical waste product is heated in a furnace and then sprayed with the saltpetre in a state of fine sub-division and under pressure. This spraying may be carried out during any period of the heat treatment, and the saltpetre may be in the form of a fine powder, which is sprayed on the ore by a current of steam or gas. The total amount of saltpetre necessary is only about 1·5 per cent. of the amount of the ore. See Patents Nos. 205,984 and 205,985, dated October 10, 1922.

Sulphide Ores and Minerals

A PROCESS has been invented by Messrs. E. F. Petersson and S. Field, of London, for treating sulphide ores of zinc to obtain the sulphur as sulphuretted hydrogen or elemental sulphur, while the ore is left in a form suitable for the extraction of the zinc by the usual methods. They obtain this result by passing dry superheated steam over the sulphide ore, which is heated to about 650° C., the reaction being endothermic. This process is more economical than the usual air roasting, since the latter involves the passage of a large volume of inert nitrogen over the ore. Sulphuretted hydrogen is liberated, and the sulphur may be recovered from it by passing over heated iron oxide together with a limited amount of air. The same effect can be obtained by mixing the steam with a limited amount of air to burn the sulphuretted hydrogen. The use of steam is particularly advantageous in considering the subsequent hydro-metallurgical process for the recovery of the zinc, since it prevents the formation of silicates and ferrites which would interfere with that process. Some zinc sulphate is produced in the calcination, and this is an advantage. See Patent No. 206,207, dated July 27, 1922.

Extraction of Iron and Titanium Compounds

MESSRS. D. GARDNER, of Weybridge, and L. Taverner, of London, have improved the treatment of ilmenite, beach sands, and other raw materials containing titanium and iron, so that the iron can be obtained containing only 0·01 to 1·0 per cent. of titanium, while the slag containing the titanium includes not more than 0·02 per cent. of iron. The reducing agent is chosen so that the difference between the specific gravity of the slag and the metal is as great as possible, and the reducing agent should preferably contain iron or titanium, so that undesirable substances are not introduced into the charge. Suitable reducing agents are ferro-silicon of high silicon content, and titanium silicide. Calcium silicide and other silicides may, however, be used, and ferro-titanium of high titanium content may be used as an additional reducing agent. The presence of manganese in the slag is undesirable, and it may be prevented by adding 1 per cent. of calcium carbide towards the end of the reduction process. The exact composition of the reducing agent is determined by a consideration of the required characteristics of the slag. The ingredients of the charge are preferably in molecular proportions, and the reduction is carried out in a furnace having a basic lining. See Patent No. 207,247, dated August 21, 1922.

Recovery of Aluminium from Waste Products

D. R. TULLIS, of Clydebank, Scotland, has patented a process for recovering pure aluminium from skimmings, dross, ash, small cuttings, and turnings resulting from the manipulation

of the metal. These waste products are impregnated with an aqueous solution containing a small proportion (5–7 per cent.) of soluble inorganic salts of the alkali metals or alkaline earth metals, or soluble compounds of ammonia, aluminium, and zinc. The mixture is then heated in a coke, gas, or electric furnace to 1,500° C., and the pure molten aluminium decanted off. See Patent No. 207,679, dated October 27, 1922.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

ALLOYS.—The modern concept of solid solutions. Z. Jeffries and R. S. Archer. *Chem. Met. Eng.;* Part I, November 19, 1923, pp. 923–926; Part II, November 26, 1923, pp. 966–969. Working information regarding the constitution and properties of alloys

Aluminium bronze. *Metal Ind.* (*Lond.*), December 7, 1923, pp. 505–508. Constitution, properties and industrial uses; their founding and working.

Admiralty gun-metal. S. G. Homfray and F. Adam. *Metal Ind.* (*Lond.*); Part I, December 21, 1923, pp. 558–560; Part II, December 28, 1923, pp. 579–580.

GENERAL.—The study of stress-strain problems by means of Röntgen rays. *Engineering;* Part I, December 14, 1923, pp. 750-751; Part II, December 21, 1923, pp. 762-763. Illustrated with radiograms showing the changes which increasing fineness of grain and increasing amounts of stress and crystallisation produce in aluminium.

The behaviour of metals subjected to repeated stresses. H. J. Gough and D. Hanson. *Roy. Soc. Proc.*, November 23, 1923, pp. 538-565. Studies of the micro-structure of materials, chiefly "Armco Iron," when subjected to static tensile stresses and reversed bending stresses; mechanism of fatigue.

ALUMINIUM.—Impurities in aluminium. J. Czochralski. *Z. Metallkunde*, October, 1923, pp. 273-283 (in German). Inclusions of oxides, carbides, phosphides, sulphides and metallic sodium; formation and examination; influence on mechanical properties.

MAGNESIUM.—Magnesium in the foundry. H. J. Maybrey. *Metal Ind.* (*N. York*), October, 1923, pp. 398-399. Methods of casting magnesium and its alloys.

ANTIMONY, LEAD.—The production of antimony and lead. *Metal Ind.* (*N. York*), October, 1923, pp. 391-393. A visit to the works of Cookson and Co., England.

STEEL.—Characteristics of some manganese steels. J. Strauss. *Trans. Amer. Soc. Steel Treating*, December 23, 1923, pp. 665-708. Mechanical, electrical and magnetic properties of commercial manganese steels; photographs of their micro-structure.

Making and testing steel balls. K. H. Lansing. *Iron Trade Review*, December 6, 1923, pp. 1549-1552.

Refractories in the steel industry. J. S. McDowell. *Blast Furnace & Steel Plant;* Part I, October, 1923, pp. 525-529; Part II, November, 1923, pp. 569-574. Summation of data regarding refractories and description of their uses in iron and steel industry.

IRON.—Physical tests of grey iron. J. Shaw. *Engineering*, December 14, 1923, pp. 755-756.

Titanium in iron. E. Piwowarsky. *Stahl u. Eisen*, December 6, 1923, pp. 1491-1494 (in German). Criticism of earlier work on the influence of titanium; some experiments and conclusions.

CORROSION.—Water-line corrosion. K. M. Watson. *Metal Ind.* (*Lond.*), December 21, 1923, pp. 553-554. Theory of corrosion in condenser tubes, illustrated by simple experiments.

ANALYSIS.—New methods in metallurgical analysis. T. B. L. Cain. *Metal Ind.* (*Lond.*), December 14, 1923, p. 529. Detecting magnesium; estimating small proportions of copper, lead, magnesium and calcium.

ELECTRO-METALLURGY.—Manufacture of ferro-vanadium by the electric furnace. E. K. Scott. *Engineer*, December 14, 1923, pp. 636-637.

Improved electric melting furnace for alloys. T. F. Baily. *Chem. Met. Eng.*, December 10, 1923, pp. 1062-1063.

Commercial Intelligence

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ALPHA ELECTRIC AND OXY ACETYLENE WELDING CO., LTD., Newport (Mon.). Registered December 10, £2,000 debentures, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge.

ASTON CROSS FOUNDRY CO., LTD. Registered December 12, £2,000 debentures; general charge. *Nil. September 25, 1923.

DREW-BEAR PERKS AND CO., LTD., London, S.W., ironfounders. Registered December 13, £6,100 1st debentures (ranking *pari passu* with outstanding debentures of previous issues) (secured by Trust Deed dated December 10, 1923); general charge. *£12,500. January 2, 1923.

EALING PARK FOUNDRY, LTD. Registered November 22, £2,000 debentures, part of £10,000; general charge. *£5,000. May 29, 1923.

LUTON IRON FOUNDRY CO., LTD. Registered December 14, mortgage to Bank, charged on 14 to 28 (even), Cobden Street, Luton. *£7,000. June 6, 1923.

STEPHEN FISHER AND CO., LTD., Sheffield, ironfounders. Registered December 6, mortgage to Bank; charged on Pelham Works, Sylvester Gardens, Sheffield. *Nil. January 13, 1923.

Vickers New Power Plant Co.

VICKERS, LTD., announce that a new company has recently been registered under the title of Vickers and International Combustion Engineering, Ltd., for the manufacture of power plant equipment. The new company has an initial capital of £500,000, which is held by the two companies in equal proportions, and is the result of negotiations lasting several months between Vickers, Ltd., and the International Combustion Engineering Corporation of New York. The new company will manufacture at its own works at Barrow-in-Furness boilers especially adapted for the burning of coal in pulverised form, super-heaters, economisers, Raymond impact pulverisers, dryers, air heaters, and all other auxiliary power plant equipment. The directors are: Sir A. Trevor Dawson (vice-chairman and managing director, Vickers, Ltd.), Mr. Mr. G. R. T. Taylor (chairman and managing director, Taylor Bros. and Co., Ltd., director of the London Midland and Scottish Railway), managing director, and Mr. G. E. Learnard and Mr. W. R. Wood, president and vice-president respectively of the International Combustion Engineering Corporation. Temporary offices have been taken at 4, Central Buildings, Westminster.

Mineral Flotation Problems

IN a paper issued by the United States Bureau of Mines dealing with "Certain Interfacial Tension Equilibria Important in Flotation" (No. 262) attention is drawn to some of the theoretical aspects of the flotation method of separating ores. The knowledge of this method, with its many difficulties, is largely empirical, yet it is annually used in the concentration of some 70 million tons of ore. The Paper is in two parts—the first dealing with the equilibrium of the interfacial tensions between two liquids and a gas. In the second part which deals with the problem of a liquid, a solid, and a gas in contact, it is pointed out that the factor determining whether a liquid will flow over a given solid is the angle of contact between the liquid and the solid. A liquid has less tendency to flow over a convex surface, as is shown by the phenomenon of the overfilled tumbler; thus in fine powders, the particles of which are highly convex, the liquid does not "wet" them, hence they float on the liquid, explaining why minerals float away by film suspension in gold sluices, on the concentration table or on the film suspension machine.

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor, THE CHEMICAL AGE, 8, *Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

Refractory Materials in Steelworks

WHEN it is considered that without the aid of refractory materials the majority of our most important industrial processes would be unable to proceed, it is a remarkable fact that the science associated with these substances is still only in its infancy, and it is only during the present century that we have thrown aside our rule-of-thumb methods and commenced to apply science where previously rather haphazard practice was almost solely relied on. Even now, it can truly be said that although in less than a couple of decades an enormous amount of careful scientific investigation has been carried out in connection with heat-resisting materials, we still know comparatively little of what remains to be learnt about them. To the metallurgist refractory materials are as indispensable as fuel is to a steam boiler, yet from an article, written by a well-known authority on the subject, which appears in this issue, we learn that although theoretical precepts exist in abundance it is a matter of the utmost difficulty to turn them to real practical account. Here, perhaps, we are once again face to face with that inevitable problem of translating the research of the chemist into the operations conducted on a large scale by the engineer. The difficulty has been, and is being, overcome in the chemical industry proper, and there is little question that when a more complete *liaison* is established between the metallurgical chemist and the works or structural engineer the problems at present hampering many metallurgical processes will rapidly disappear. Unfortunately, one appears in some cases to be asking for almost the impossible when consideration is given to the specific uses of refractory materials. We must essentially have a material which is capable of standing up to considerable temperatures, and yet the same material must exhibit high mechanical strength. So far as the finished article is concerned these two conditions demand, in many materials, properties of a distinctly opposite nature. Accordingly the refractory materials producer has to do his best to reconcile two contrary requirements and find a happy medium.

A Metallurgical Congress

ARRANGEMENTS are being made to hold a number of "Empire" Congresses in connection with the forthcoming Exhibition at Wembley. The electrical trades are organising what is called a World Power Conference, not to discuss, as its title might imply, matters more usually regarded as coming within the purview of the League of Nations, but for the consideration of power supply resources. A conference of more immediate interest to metallurgists is the Empire Mining and Metallurgical Congress, to be held from June 3 to June 6. To a certain extent these congresses will overlap, as the Institution of Mining Engineers and the Mining Association of Great Britain are both concerned with the prime source of power, coal, and the modes of deriving power therefrom. This overlapping is, however, by no means an evil, as it is advantageous, very often, to discuss a common subject from more than one angle, and coal can be viewed from several angles according to the ultimate purposes to which it is to be put. The proposed Mining and Metallurgical Congress will, moreover, cover a wide field which is more particularly its own. The convening Institutions include, in addition to those already referred to, the Institution of Mining and Metallurgy and the Institution of Petroleum Technologists, who will conjointly take in hand the sections in which they are directly interested, while the Metallurgical Sections are being organised by the Iron and Steel Institute and by the Institute of Metals, with the help and countenance of the National Federation of Iron and Steel Manufacturers. The two technological institutes concerned are admittedly the most important associations connected, respectively, with Ferrous and Non-Ferrous Metallurgy.

Objects of the Congress

AMONGST the objects which this Congress proposes to effect is the formation of an Empire Council of Mining and Metallurgical Engineering Institutions, which is, *inter alia*, to create and maintain throughout the Empire a high standard of technical efficiency and of professional status, and, if found desirable, to establish a Register of British Mining and Metallurgical Engineers. This is a laudable proposition, and follows on the lines of the newly granted charter of the Institution of Civil Engineers, which debars anyone not a a corporate member of that Institution from describing himself as a "Chartered Civil Engineer." Originally the Institution of Civil Engineers sought far wider powers, its proposal having been to prohibit anyone not a member of the Institution, calling himself a "Civil" engineer. This proposal was abandoned largely at the instance of other engineering associations whose members, unless members of the Institution of Civil Engineers, would have been debarred from calling themselves civil engineers, and were, therefore, not unnaturally, hostile to the suggestion.

Professional Status

IN the medical professions and in the legal profession the door is effectively bolted and barred against all and sundry who are not duly qualified by strict examination, of the efficacy of which the General Medical Council and the Incorporated Law Society are virtually, and in the last resource, the judges. No man or woman, therefore, may practise medicine or law unless they have been placed on a register which is in the keeping of one or other of these bodies. That the general public benefit by these restrictions is hardly to be contested, and it would therefore appear to be only logical that incompetent persons should be legally disqualified from representing themselves as competent chemists, metallurgists or engineers. In practice, and amongst those who know, there are certain magic letters which serve as a real substitute for a legal status—such, for example, as the Associateship or Fellowship of the Institute of Chemistry. These are only to be gained by strict examination and proper apprenticeship. In regard, however, to membership of such institutions as those which are co-operating to promote the forthcoming congress, it has to be freely admitted that the conditions imposed are not in themselves such as would confer any professional status on those admitted to membership. If, therefore, the proposed Empire Council can devise the necessary means of establishing, without the infliction of undue hardship upon persons morally but not technically qualified in the narrower sense, a register of truly competent mining and metallurgical engineers they will achieve a difficult, but wholly beneficial, task.

Refractory Materials for Steelworks

Their Uses and Essential Properties

The author, speaking from a long and intimate practical knowledge of the subject, discusses the uses of refractory materials in steel works and the essential properties they should possess in order to ensure satisfactory results.

In these days of swift scientific progress it is unusual to find a subject about which little is known; it must, however, be admitted that with regard to the practical and technical side of ferrous metallurgy the study of refractory materials has been neglected, owing no doubt to the fact that researches on other metallurgical questions have offered easier and more satiefactory solution.

We have, however, now come to a stage in the development of our steel industry at which we find that the latest improvements on both the engineering and chemical sides of metallurgy are being to some extent nullified by the fact that working conditions on the refractories side of the question are not modernised to the same extent.

The remedy would appear to be fairly simple, but on close examination of the subject it is realised that although of theoretical matter there is an abundance, yet to make practical use of any of this information is a matter of the utmost difficulty; in short, the greater part of our present stock of knowledge on the subject of refractory materials may be described as "interesting, but not very instructive"—that is in so far as the technical side is concerned.

What "Refractory" Means

It is self-evident that much careful, and withal tedious, work must be done, so that the severely practical question of obtaining the best possible refractories for modern steelworks may be settled. One wonders whether the significance of the word "refractory" is really understood in the steelworks sense of the term. According to some dictionaries and works of reference "refractory" means "difficult to fuse." Obviously this does not satisfy us with regard to steel manufacture, for in a steelworks a refractory material must possess a multitude of qualifications.

Taking a broad view of the whole subject, a refractory material in use should at least possess the following properties: (1) It must adequately resist a higher temperature than that which working conditions require. (2) It must be prepared to withstand sudden changes of temperature. (3) It must possess considerably more mechanical strength than that which one anticipates it will be called upon to show.

These qualities should be possessed by all refractories; the more particular details of working give rise to innumerable other properties required, such as: (1) Resistance to crumbling and shattering, in the case of bricks. (2) Absence of any signs of partial fusion of certain constituents of the bricks, resulting in gradual alteration of shape due to pressure. (3) Resistance to corrosion of bricks or linings by molten metal or slag, *i.e.*, due to chemical action. (4) Resistance to continual abrasion of molten metal and slag, flue dust, etc.

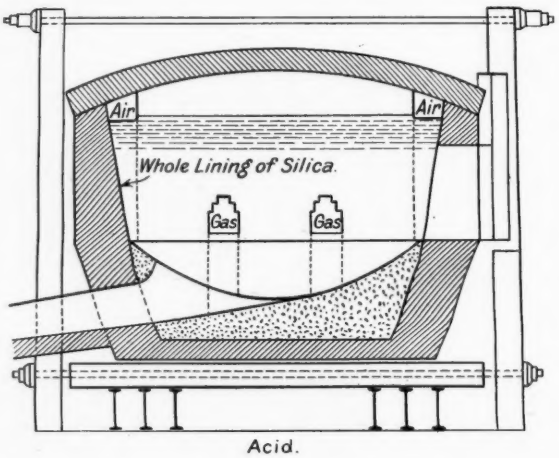
It is absolutely essential that a refractory material should be chosen solely and particularly for the work in hand, since what may be perfectly satisfactory for all other classes of work may possess properties rendering it unsuitable for our particular purpose.

The processes and methods of working in a modern steelworks are so complex and various that it may be as well to outline the chief operations in which particular refractory materials are required: (1) Open Hearth Furnaces: Acid and Basic. (2) Bessemer Converters: Acid and Basic. (3) Electric Furnaces. (4) The Crucible Process. (5) Regenerators, Reheating Furnaces, etc. (6) Moulds.

Open Hearth Process

1.—*The Open Hearth process* of steelmaking, whilst retaining the original theoretical considerations of Siemens, has been so elaborated and improved from the engineering standpoint that nowadays the difficulty with regard to refractory materials seriously limits the process. This fact applies primarily to the acid process, but it will be realised that the basic process is no less seriously affected.

It is the invariable practice to have nearly all the refractory parts of an acid open hearth furnace made of silica bricks. So far as our present knowledge will lead us, this is the only form of refractory which is at all suitable, and it must be admitted that, due to the modern improvements in furnace



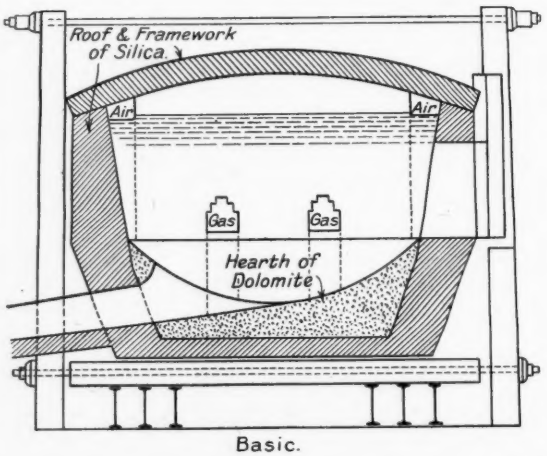
Acid.

design, methods of operation and quality of bricks, a silica brick lining is made to perform its function much more satisfactorily than was the case 10 or 15 years ago.

At the same time, one may say without exaggeration that could a refractory material be found which should possess all the durability, etc., of the silica brick, and which would withstand a temperature of 200° C. higher than the silica brick, then the cost of production of acid open hearth steel could be reduced very considerably indeed.

Surely some organised research on this subject alone would be well worth while.

The lining of an acid open hearth furnace is constructed almost entirely of silica brickwork. The bottom of the furnace is shaped out in brickwork, and then a layer of silica sand is gradually sintered in to form the actual hearth surface. This hearth is then saturated with slag before steelmaking



Basic.

commences, so that when the furnace is worked the hearth consists of sand and slag; the slag fills up the interstices between the silica grains, and during melting it is actually the slag admixture which gives the hearth its stability. If the sand should contain any clayey matter, there will be

serious "spalling" away of the hearth in patches, but using pure sand (free from clay) it is not the hearth itself which is the weak point.

The weakness of the lining of an acid open hearth furnace is in the roof and walls. The reason for this is that although a good silica brick would not melt below about 1,750° C., yet it would soften very considerably at a temperature of about 1,550° C.

Thus, great care must be taken with regard to roof and walls when a melting temperature is attained, and no part of the lining can be heated above about 1,700° C. The only places in the furnace where this temperature is permitted are round about the gas and air ports, these being of necessity the hottest parts of the furnace.

The working life of such parts is exceedingly short. Thus we see that the temperature of the bath is limited to say 1,600° C. as a maximum. To work a larger furnace at a temperature of 1,750° C. or 1,800° C. would enormously reduce the cost of production.

Though concerned with acid materials, these factors are equally potent with regard to the *Basic Open Hearth process*, since in a basic furnace the walls and roof are made of silica brick, so that although the lower half of the furnace would resist higher temperatures the upper half acts precisely as in an acid furnace.

Moreover, with a roof of silica brick, there is always the danger at high temperatures of dripping of silica: in a Basic furnace this would, of course, ruin the constitution of the slag; so that the temperature of the furnace is still more restricted.

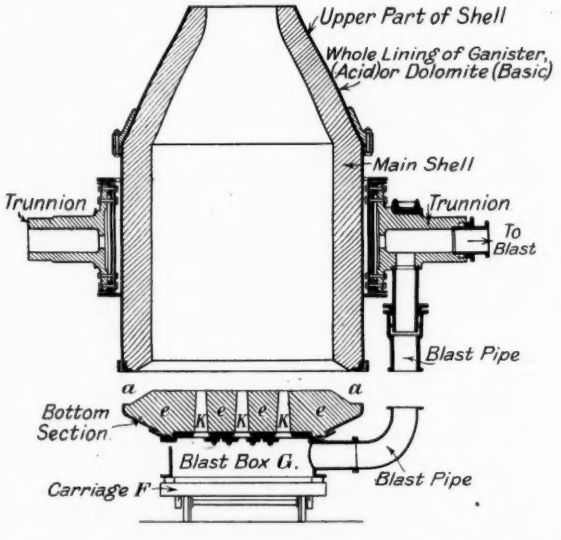
Bessemer Converters and Electric Furnaces

2.—With regard to Bessemer converters, the position is fairly satisfactory:

Basic converters are quite sound with a dolomite lining, whilst *acid converters* with ganister linings "wear" fairly well.

Ganister, as rammed into Bessemer converters, will withstand the temperature which that process of steel-making entails, and it is doubtful if any better material could be found. It is naturally of the utmost importance that in both acid and basic converters the ramming of the lining should be performed most efficiently.

3.—*Electric Furnaces.*—Here again the position is fairly satisfactory, though, could a refractory of the silica brick type be found which would withstand a higher temperature, improvements in the process would result.

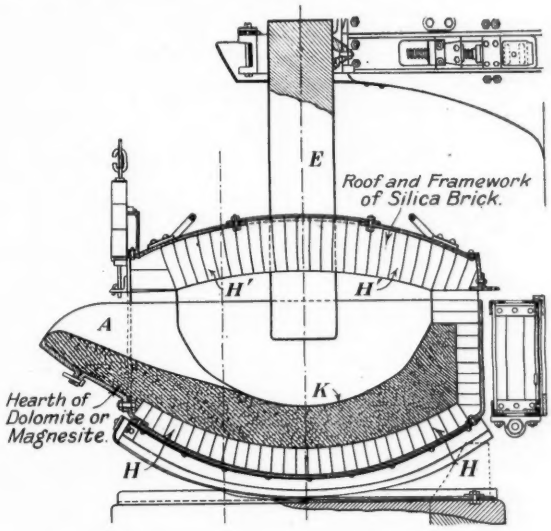


Practically all electric furnaces have basic linings: this means dolomite or magnesite with admixtures of tar, basic slag, etc. Such linings are eminently satisfactory for electric furnaces and could scarcely be improved upon. The roof and top portions of the walls are, however, generally made of silica bricks: thus various troubles arise. The chief danger is the dripping of silica into the slag, as in basic open hearth practice; the trouble of roof and wall weakness does not arise to any extent, since the top half of an electric furnace is the cooler one; hence the bath may be worked at a higher temperature than that of the furnace roof.

This roof is, moreover, comparatively small and does not need much support, yet the fact remains that, as in the open hearth furnace, a refractory material having suitable properties at 1,900° C. or 2,000° C. would be invaluable.

In connection with this, the claims of Zircon (Zirconium Silicate $Zr\ Si\ O_4$) may be urged. This material has a melting point of well over 2,000° C., and is quite unaffected by furnace atmospheres, etc.

The objection to its use is its present high cost, but there is always the possibility of its becoming much cheaper.



Crucible Process

4.—*The Crucible Process.*—This process is perhaps the only one which can be regarded as perfect from the refractories standpoint. It is the oldest of the real steel-making processes and yet the alterations made have been very few.

As regards refractory materials, the process resolves itself into a crucible and a lining to the melting hole. Many different recipes have been suggested for crucible making, but the choice really lies between a clay "pot" and a plumbago one.

The clay crucible which is favoured in England is made from a mixture of several home clays, with an addition of coke dust. Such a crucible, properly manufactured, will withstand the temperature of the melting hole admirably, possessing a considerable porosity and yet sufficient mechanical strength to combat the handling necessary.

It may be urged that the life of a clay crucible is short, and that a more lasting material should be found, but it is extremely doubtful if a better combination of properties could be found in any material than those possessed by the clay "pot" of which the following is a typical recipe:—

	Per cent.
China Clay	10
Stourbridge Clay	45
Derby Clay	20
Stannington Clay	20
Coke dust	5

Such a mixture, when made up with a proper amount of water and after being well trodden, will make an excellent crucible, but all the good work may be undone if the "pot" is not properly burned. The burning should be very slow, particularly through the critical ranges (100-150° C., 500-600° C., 850-900° C.), and the "pot" must not be allowed to cool between this burning and its use in the melting hole. Thus we see how delicate is the preparation of a crucible, and yet, when properly made, it is the most reliable of our present refractory materials.

Plumbago crucibles certainly have a much longer life than clay ones, and are much favoured in America, but the great

objection to their use is the fact that carbon invariably passes from the crucible to the metal. This, of course, condemns them for the making of crucible cast steel.

The lining of the melting hole is usually made of ganister: this is probably due to the handiness of the supply, but, nevertheless, such a lining is fairly satisfactory in the case of coke-fired furnaces.

In larger gas-fired furnaces it is the modern practice to line the melting chamber with silica bricks or high-grade firebricks. The result is a much longer life for the melting-hole lining. Since crucible furnaces are liable to sudden variations of temperature, the upper part of the hole should be lined with coarse grain bricks to prevent cracking. The lower part, which is protected from violent change of temperature, may be of closer grain bricks in order to withstand corrosive and abrasive action.

Regenerators, Reheating Furnaces, etc.

5.—Such parts of a steel-making concern as *regenerators, recuperators, ladles, annealing and reheating furnaces, flues, core stoves, etc.*, are worthy of consideration regarding the kind of refractory material which is used in their construction. Too often is it the case that false economy is exercised in the cutting down of expenses by using poor quality bricks for the refractory lining of some of these important details of a steelworks.

In the case of regenerators, recuperators and air stoves generally, the main damage to the refractory used is caused by the abrasive and corrosive action of dust-laden gases. Basic bricks, such as magnesite, would be ideal for combating this trouble, but they are regarded in most steelworks as too expensive, and, moreover, there is a danger of cracking and "spalling away" due to sudden changes of temperature. The general practice is to use firebricks, but it is essential to use high quality, hard-burned bricks, since a faulty firebrick is soon attacked, leading to a general disintegration of a mass of brickwork.

Annealing and reheating furnaces should be made of good quality firebricks, particularly parts such as firegrate, arch, etc., where the greatest effects of working are felt; silica brick is often used in the construction of such portions.

Core stoves, flues, etc., where the temperature is fairly low, may be lined with less resistant firebrick, but the exact nature of the work in question must determine the type of lining which is most suitable.

Preparation of Moulds

6.—*Moulds.*—This heading comprises the most important part of the work in some steelmaking concerns, since a large foundry may be a source of great revenue or of great loss according to whether or not the moulds used are satisfactory.

Ordinary ingot moulds should not present much difficulty; providing the mould is properly "faced," all should be well.

It is in the case of steel castings that trouble arises; these are cast in moulds prepared from a refractory mixture known as "moulders' compo," or else in a mould of prepared sand such as is used in iron foundries. These sand-moulds are usually for light castings only and are quite satisfactory.

The nature of "moulders' compo" varies indefinitely: either it is made in the steel foundry or bought in bulk in a prepared state. Roughly, such compo consists of burnt fireclay, which is ground fairly fine, and then, after admixture of other materials, is moistened until of a sufficient consistency for moulds to be prepared. The moulds are made in this damp state and are subsequently dried slowly in stoves. The moulds are then faced in the same way as ingot moulds, and are ready for receiving the molten metal.

There is almost incredible divergence of views as to what the raw material of a compo should be. The base material is usually burnt fireclay (grog) and to this are added whatever ingredients the firm in question regard as helpful. Raw clay is usually a constituent since it serves as a bond for the moistened mass: coke dust is also added to give additional porosity to the compo. Ground ganister and silica bricks are said to improve the qualities of a compo, and an addition of sand is also recommended.

It will be seen that the number of different kinds of compo is very large; usually the secret of a successful compo is well kept, since it is universally admitted that the nature of the compo used has a great effect on both the surface and general soundness of the casting.

A properly prepared mould made with a perfect compo should of course give a casting with a good surface "skin" and with a perfectly sound interior; moreover, the compo should not adhere to the metal.

Unfortunately, this is the exception rather than the rule, and this is another phase of steelmaking with ample scope for investigation and research.

A compo must be sufficiently resistant as regards the temperature of the molten steel; it must be mechanically strong and yet it must be sufficiently porous to permit the escape of gases: again, it must be capable of withstanding the "Wash" of a flow of molten metal. Truly, moulders' compo must possess a variety of qualities.

Importance of Right Materials

It will be seen from a consideration of the above statements how exceedingly important is the question of the choice of suitable refractory materials in a steelworks; it is unfortunately much too easy to lose money on certain classes of work due to injudicious choice of bricks, etc.; it must be borne in mind that the price of bricks, etc., is no criterion of quality for any particular job. Only by actual trial and experience can we gauge the value of any particular refractory: in these days of bad trade, however, the expense of making any drastic alterations, say, in furnace linings, is too great, unless one can be fairly certain of a satisfactory result. The only remedy, therefore, is the undertaking of some organised research on the subject, and, moreover, research not merely on scientific lines, but also from a technical and practical point of view.

It cannot too strongly be urged that chemical composition of refractories is only of value up to a point: exactly how much faith one can put in chemical analysis of steelworks refractories depends upon circumstances, but in most cases one can say with confidence that there are other factors of at least equal importance.

The state of aggregation of a refractory material is very important: in bricks of all descriptions, the grain size is a consideration of the utmost importance; this fact also applies to moulding compos.

Again the porosity of a refractory is important, and, though the grain size may affect that porosity, it is not by any means the only source of variation. Mechanical strength is of course of great moment, especially in the case of bricks for furnace linings.

With all these several influences at work, it is not surprising that occasionally a little investigation is started on this subject only to be abandoned in despair because the results obtained are apparently contradictory; no work on this question is of real value unless it is carried out in an exceedingly painstaking fashion, and steps must be taken to ensure that all the influences at work are allowed for, and also that all the requirements of the particular case are satisfied. Unless this is done, the result is that the refractory material recommended is found to fail in some particular fashion which had never been considered.

In conclusion, the urgent need of the steel industry for a material with the stability of the silica brick and the capability of adequately withstanding a temperature of 2,000° C. must again be emphasised.

The discovery of such a material, procurable at a reasonable price, would most certainly make an immense difference in the steelmaking world.

Big Contracts

During the month several large contracts have been placed, which will materially help the steel trade. Messrs. Armstrong, Whitworth and Co. have secured an order from the Government of South Australia for 30 modern engines at a cost of nearly half a million pounds. The locomotives will be built at Scotswood, and will provide considerable extra employment for some months.

Sir William Arrol and Co. have obtained the contract for the Avonmouth Dock extension at Bristol at a cost of £554,000. This will provide employment for some thousands of men, and will mean the placing of considerable orders for structural steel.

Orders for a number of new steamers have been placed at Newcastle and Clydebank; and it is interesting to note that the Greek Goverment are sending four destroyers to be reconditioned by Messrs. J. S. White and Co., of Cowes.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

Statistics of Production

THE pig-iron production of Great Britain in 1913 amounted to 10,260,000 tons, the biggest on record for this country. The steel output for that year was 7,663,876 tons, this output continuing to increase throughout the war years until, in 1918, it too, touched record height, with a total of 9,591,428 tons. In the year just ended, according to the Statistical Report of the National Federation of Iron and Steel Manufacturers, the steel output was 8,488,900 tons, over three-quarters of a million tons more than the 1913 production and approximately only some million tons less than that of the record year, 1918. On the other hand the pig-iron output in 1923 was only 7,438,500 tons, that is, two and three-quarter millions less than in 1913. A few more figures and it will be possible to point a moral and adorn the tale.

The Decline in Actual Production

THE imports of pig-iron into Great Britain in 1913 are given as 174,774 tons, and the exports as 945,262 tons. In the year just ended, and subject to revision, the imports of pig-iron have been, approximately, 114,000 tons, and the exports 750,000 tons. It is evident, therefore, that the steel trade did not, in either year, have to rely to any appreciable extent on foreign pig-iron for supplies for conversion. In 1913, however, 10·2 tons of pig-iron corresponded roughly with an output of 7·6 tons of steel—ignoring for the moment what proportion of the pig-iron output was actually used in foundries, puddling furnaces, etc., in the production of iron, as compared with the actual consumption of pig-iron in the manufacture of steel. In 1923, however, the ratio is 7·4 tons of pig-iron to 8·4 tons of steel. Now, as in normal and healthy practice steel is made from pig-iron, it is evident that in present practice steel is actually being made from something else. That something is, of course, steel. Hence, whereas the figures for past years show the actual increases, more or less, in the amounts of steel made in any given past year, the figures for recent years by no means imply increased contributions to the available stocks of steel. In other words, the amount of new steel being produced in this country is far less than that implied in any formula relating to the production of steel ingots. So long as increasing quantities of existing steel are being used up again to make ingots, and as long as the blast furnace outputs of pig-iron decrease, the amount of steel actually made, in the sense of being currently available to consumers, must fall, and, by parity of reasoning, the actual amount of iron available must fall likewise. This process is taking place all over the world ; less so in the United States, and more so in Italy, where the steel charges in open-hearth furnaces actually often consist of 100 per cent. scrap, but generally speaking, it is taking place at home, in France, in Belgium, and in Italy.

Future Practice in Steel Making

THIS actual decrease in the output of new steel is in all probability an important factor in maintaining high prices. On the other hand, it is obviously a temporary phase only. The amount of available scrap is in part the aftermath of the war ; when the supplies are exhausted either a normal amount of iron ore will have to be smelted by normal ways or a world famine of steel with consequent paralysis in the engineering, building, and constructional trades will ensue. Ordinary economic considerations of supply and demand will then come into play. Practice will have to keep pace. In the meanwhile it is important to remember that the production of steel ingots in any given country does not at the present moment represent by any means the amount of fresh steel manufactured. The steel trade is being kept going by a method not altogether unlike the intrinsically unsound economic process of taking in each other's washing.

Gas Engine Prospects

THERE has been of late a renewed interest evinced by iron and steel manufacturers in gas engines. Gas engine practice has for many years developed far more in America and in Continental countries than at home. Early experience—or, rather, inexperience—has largely been to blame for this. Before the war, several works had installed gas engines, made in Germany, and these seldom gave anything like as good results as their makers claimed for them. Spare parts and repairs likewise constituted considerable difficulties, as the former had in most instances to be obtained from the country of origin, and this was not easy. During the war it was of course impossible. Finally, manufacturers were chary of putting all their eggs into one basket to the extent implied by installing gas engine sets only, and a steam set was usually provided as a stand-by in case things went wrong. The problem of what to do with week-end gas in " mixed " works also introduced difficulties. In the result, not a few works scrapped their gas engines, and the British gas engine itself shared for a time the disfavour with which the gas engine in general was regarded. Now, however, there are indications that this economical and excellent prime mover is about to come into its own. Whether the new movement will be successful or not depends, however, upon a factor of supreme importance, respecting which many conflicting views are held, yet which is a decisive element in determining whether gas engines can be run with the efficiency and economy which can alone justify their installation. This factor is the method of cleaning the gas, which, in most cases, will be blast furnace gas derived from the works itself. In the case of other power gases the problem will of course be simpler, viewed from the standpoint of cleaning only.

The Gas Cleaning Problem

BEFORE blast furnace gases can be used in a gas engine they must be properly cleaned. Indeed, dirty gas is unsatisfactory even under boilers, although, as is well known, less cleaning is necessary. The solution favoured at some works, especially in Germany, is to clean all gas down to a virtual minimum, whether it be destined for use under boilers or for use in gas engines. The question of what method of cleaning should be adopted, and whether the gas should be dry cleaned or wet cleaned is one upon which a good deal of data has been accumulated of late years. In this country, during the war, and mainly owing to the need for supplies of potash, which were becoming dangerously scarce, the Halberg-Beth system was more or less forced by the Government upon manufacturers. It was a good system, and doubtless subserved the needs of the time, but it is doubtful whether it was ever popular, and, as things are now, it is costly as regards labour and maintenance. The general concensus of opinion to-day amongst blast furnace managers is that wet-cleaning methods are, generally speaking, cheaper than dry-cleaning methods. It is for the blast furnace men to choose, amidst a number of competing types of wet-cleaners, one which will best respond to their needs.

The Brassert Washer

IN any case it is a counsel of perfection to clean all the gas to the greatest possible extent, as well as being economically unsound. The great bulk of the blast furnace gas will be required under boilers and for stoves, and, even in the most advanced German practice, it is seldom that less than 70 per cent. of the make is consumed in this way. The problem narrows itself into one of seeking the best mode of cleaning adequately the gas produced, so as to use it for these purposes ; the surplus can, if necessary, be cleaned further for use in engines at far less expense than if the whole of it is cleaned to this extent. Here again it is found that the wet method of cleaning gas is preferred, both on the grounds of initial outlay and of subsequent expense for labour and maintenance. The amount of water required may be a deterrent, but need not necessarily be one, as means can be adopted for using the water again and again and for recovering the sludge in a condition highly favourable for sintering or briquetting. In this connection it is interesting to learn how popular the Brassert system of wet-cleaning is becoming abroad, particularly when combined with a Dorr thickening installation.

According to the latest available information no fewer than 93 Brassert washers have already been put in operation in the

United States, in Canada, and on the Continent, and wherever used they appear to have given unqualified satisfaction. The Brassert washer consists of a circular steel tower fitted with baffles and hurdles, the bottom hurdles being sprayed from a number of nozzles, and in such manner as to give a swirl of finely divided mist at high velocity. The incoming gas is, so to speak, churned up in this mist and emerges from the washer with, on an average, less than 0.20 grains of dust per cubic foot, while the water consumption can be brought as low as 22½ gallons per 1,000 cubic ft. of cleaned gas. The Dorr thickener into which the wash waters are led is a circular tank, usually about 40 ft. in diameter, in which the water is slowly agitated by a central shaft carrying radial arms to which are attached short angle-irons which act as stirrers. The thickener is designed on the latest scientific principles relating to the subsidence of suspended particles, and the dust falls to the bottom, whence it is automatically withdrawn. The water can be used over again with a wastage of only 1½ gallons per 1,000 cubic ft. of gas cleaned. The concentration efficiency of a properly designed and operated plant is stated to be 99·1 per cent.

Regenerator Design

THE line between researches and memoirs which aresometimes somewhat contemptuously styled by the so-called " practical man " academical and those which are of immediate workshop utility is often hard to draw. The design of gas chambers in open-hearth practice has too often been of the perfunctory hit or miss type, and while empiricism may lead to very useful and practical results it is not to be advocated in connection with so expensive a tool of production as a modern open-hearth steel furnace. Hence attention may be directed to a number of articles which have appeared of late in the French technical press on the little-known subject of regenerator design and construction. Amongst the recent investigators who have published results bearing on regenerator practice are Noaillon, Xhignesse and Seigle. The latter in particular has investigated the heat-exchanges between chequer work and gas, on the one hand, and air, on the other. To the extent to which these researches depend on pure theory and need for their elaboration pure mathematics, such researches may be regarded perhaps as academical, but they have a very real bearing on a subject of very real, immediate, and practical importance. Mr. Seigle has, for instance, come to some very important conclusions as to the influence of increasing the length of the channels in the chequer-work of the chambers, and on the influence of the thickness of the bricks, which, while by no means in accordance with the accepted views, appear to repose on a solid basis of ascertained scientific fact, supported by mathematical demonstration. His work will shortly be available to British readers, as it has been translated and will be published before long. Steel furnace engineers will find therein much of interest, although they may not agree with all his views.

Tellurium in Steel

LITTLE is known concerning the behaviour of tellurium in steel or of its influence on the properties of that material, and what little is known is mostly of a negative character. Metallurgists will be interested, therefore, in a research recently carried out by Professor Waterhouse, of the Massachusetts Institute of Technology in collaboration with Mr. Zavazine. The steel in question, a 3-ton heat, was made in the electric furnace, and the tellurium additions were made in the ladle. About 40 per cent. was retained in the metal, which ultimately contained 0·12 per cent. of tellurium. The steel showed a diminution of ductility, and at high magnification (X1000) a new constituent could be discerned, associated with the dove-gray manganese sulphide familiar to metallurgists through the work of Professor Arnold and of the late Dr. Stead. On forging, this constituent, which Professor Waterhouse believes to be a telluride, does not break up, but elongates, like manganese sulphide. A compound, Fe Te, is already known to exist, and its heat of formation has been determined. Physically this telluride of iron is rather tough, and hard enough to scratch glass. It is probable, therefore, that its presence in steel would tend up to a certain point beneficially to influence the free cutting or machinng qualities of the material.

Some Inventions of the Month

By Our Patents Correspondent

Treating Ores

APPLICATION has been made under the International Convention by P. Gredt, of Luxembourg, for a patent for a process in which oolitic, marly, or like iron ores are crushed or ground to liberate the grains of iron ore from the gangue, and then subjected to wet or magnetic separation. Alternatively, the ore may be heated so that the calcareous gangue is calcined. The product is slaked, and then subjected to friction, and part of the gangue removed by blast-sifting. See Patent No. 206,509, dated November 4, 1922.

Concentration by Flotation

A NEW frothing agent for the flotation of carbonaceous mineral or other pulverised material has been patented by P. C. Williams and Minerals Separation, Ltd., of London. In the purification of coal gas, the crude gas from the retort is passed through coolers and a tar extractor, to remove tar and ammoniacal liquor, and then through a separator to remove the final traces of ammonia. The gas is then passed through coolers to remove an aqueous condensate, and then through benzol scrubbers, where the benzol is extracted with creosote oil. This liquor is then steam-distilled, yielding impure benzol and an aqueous condensate. The aqueous condensates from the coolers and from the distillation of the creosote have usually been regarded as waste products, and are now found to be very good frothing agents, particularly that obtained from the distillation of the benzol from the scrubber liquor. This frothing agent may be employed in the proportion of about 0·5 per cent. of the circuit water. See Patent No. 208,226, dated September 15, 1922.

Alloys and Electric Furnaces

A PROCESS for obtaining rustless iron, steel, and low-carbon alloys of chromium with nickel or cobalt, with or without iron, is the subject of an application by Electro Metallurgical Co., of New York. These are made by reducing a chromium ore by means of a non-carbonising reducing agent, such as aluminium, silicon, ferro-silicon, chrome-silicon, or ferro-chrome-silicon alloy. The products are then diluted at a lower temperature with iron or other required metal. Manganese and other deoxidising agents may be employed as usual. A tilting electric furnace is used, with a basic lining and small adjustable carbon electrodes. The operation may be started by means of a train of metal fragments, and is carried out with the aid of a layer of basic slag, the alloy being tapped off at intervals, leaving some metal and slag for the next charge. See International Convention Application No. 206,836, dated November 13, 1922.

Production of Zinc in Reverberatory Furnaces

A PROCESS has been patented by H. Mehner, of Berlin, for the large scale production of zinc in a reverberatory furnace, in which the reducing gases and vapours produced at about 1,000° C. are passed downwards through the charge. Any of the fire gases which also pass downwards through the charge do not affect it, since the carbon dioxide is reduced to carbon monoxide by the excess of carbon in the charge. The fire gases usually issue through a flue, and their proportion in the reducing gases is kept as small as possible, while the reducing gases are not allowed to pass into the combustion chamber. The proper mean condition between the two extremes is determined by the absence of zinc flames above the charge, and the absence of nitrogen in the gas which passes through the charge. The pressure in the combustion chamber should be about 100 mm. water gauge, with practically no pressure in the stack. The admission pressure of the heating gases and the combustion air should be slightly above 100 mm., and the pressure below the furnace bed may be about 10 mm. and is chosen according to the resistance of the furnace bed to the passage of gas. The furnace bed may be in the form of a grate, or of perforated or ordinary bricks, according to whether the passages through the grate are liable to become clogged with slag. The furnace may be of considerable size and the zinc vapour may be conducted from it in a single main, and condensed in a single condenser. The process is thus more economical than that in which a large number of small retorts, each provided with a condenser are used. See Patent No. 208,764, dated September 22, 1922.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE comparative quietness of the opening days of the New Year was no more and no less noticeable in the iron and steel trade than was to be expected. The reaction of the holidays had to work itself out, and it was anticipated that there would then be a resumption of the activity which had characterised the industry in the closing weeks of the old year.

Labour Ministry and Trade

In the meantime, however, a new influence began to make itself felt. The certainty of the overthrow of the Conservative Government and the coming into office of the Labour Party aroused a feeling of doubt which gradually operated as a check on the revival which had promised so well. For the past week or two the iron and steel trade has been practically marking time. Prices have been nominally unchanged, but in effect there has been a slight backward movement.

On the Exchanges and at the Birmingham Quarterly Meeting the chief topic of conversation was the "uncertainty of the political situation," the fear that the new Government would attempt to put into force some of the extreme projects of which so much was heard at the elections. And not only in the public places but in ordinary business conversations this same fear has been in evidence. The result is that the spirit of confidence which had begun to manifest itself, and which is so essential to any healthy recovery in trade, has been shaken and the effect is seen in a weakening of the market.

Yet a careful consideration of the whole position makes it difficult to justify this apprehension; there are so many reasons against it. The new leaders are largely inexperienced in the high administrative work, but they include men of great moral worth and intellectual ability, and they will approach matters from a new point of view. They are taking up the responsibility of government at a time when the affairs of the State call for the utmost exercise of those qualities. It is not unreasonable to expect that they will do no worse than their predecessors, with the possibility of an improvement, which is so much to be desired. In any case their strength in Parliament is not sufficient to render them independent of the other two parties, and that in itself is a safeguard against any extreme legislation.

Foreign Competition

Another adverse influence on the markets has been the keenness of the foreign competition. Belgian prices have been reduced; and the value of the French franc has fallen to a record figure, which has enabled the French works to underquote the English prices by a considerable margin. There has not, however, been a great amount of buying from abroad. The force of this competition has to some extent been neutralised by its suddenness. Buyers were rather taken aback, and either waited to see whether there would be further reductions or doubted the genuiness of the movement.

The Birmingham Quarterly Meeting (held on the 10th) which is the barometer of the iron and steel trade, was awaited with much interest. Naturally the two factors to which we have just referred, the political situation and the foreign competition, dominated the meeting, and the amount of business transacted was relatively small. Nevertheless, there was little discouragement, and it may be expected that when the political pessimism has worn off, as it soon will do, the recovery of trade will resume its normal course.

The low quotations which are being made by the Continental works in the English markets must be taken note of, coming as they do at a time when our costs of production and selling prices are moving upwards; and they will prevent any rapid increase in prices here. In view of the gradual rehabilitation of the German works, and the possibility of trade agreements between France and Germany, it is interesting to note that the President of the Board of Trade in the Baldwin administration stated in the House that the British Government would give the fullest measure of support to any industry threatened by such an arrangement. We may assume that that pledge will still hold.

Business Moving Again

There was a sufficient carry-over of orders from the holidays to balance the lull of the early days of the month, and business appears to be moving again. Most of the works are better off for orders, due to a large extent to the giving out of work by the railway companies, which goes steadily on. The shipbuilding and engineering trades are more active than they have been for some time, and this activity is reflected in the steel works.

Changes in prices, if any, have been within narrow limits. Pig iron has maintained its level, but has not been able to register any advance, which might have been expected from the increasing cost of fuel. No doubt the accumulation of stocks during the holidays and the low prices of Continental iron are the reasons for this. There is no relief in the coke situation. Supplies are still scarce and furnaces are being put on slack blast. Considerable quantities of basic iron have been imported.

Manufactured iron has kept fairly steady and the demand maintains the improvement; but here again the Belgian works are coming in with reduced prices, which make it difficult for the iron makers to retain their selling prices at the level which the cost of production justifies.

The Steel Trade

In the steel trade the tone is healthy. Nominally prices are unchanged, but actually there has been some amount of business placed at a few shillings below the nominal market prices. Orders for tank plates have been booked at £10 5s., although the market price stands at £10 10s. Sections remain at £10 basis, but the same thing applies to these. It must not be forgotten that the merchants covered themselves before the higher prices came in, and they are now able to bid for new work at under to-day's prices. While there is not so much demand for the thicker plates, there is a good business in the thinner plates under ¼ in., and it is difficult to obtain quick delivery of these. Steel billets have receded somewhat, but they are firm at £8 5s. to £8 10s. The Belgian prices are very much below this, and large quantities have been bought, but the great disadvantage there is the delay in delivery.

The satisfactory progress of the industry during January has been disturbed by the railway strike. There is no need to enter into the details of the dispute here, but it is a great pity that the trouble broke out at a time when trade was getting on to its feet again, so to say. Although the strike was only partial it caused serious dislocation.

There is still another disquieting element in the present situation, that is the prospect of trouble between the colliery owners and the miners. The men are dissatisfied with the existing wage agreement, and a ballot is likely to be taken to decide whether to terminate the agreement.

National Smelting Co.

An announcement of considerable interest to the steel trade was made in the early part of the month in the issue of debentures by the National Smelting Co., Ltd. Prior to the war a large portion of the spelter used in the galvanising trade was supplied to us by Germany, who made it from the zinc concentrates obtained from Australia, and sold it here at a price which the English works could not touch.

During the war an attempt was made to remove this disability and a new plant was erected for the purpose at Avonmouth, in addition to the other plants which were already in existence. For certain extraneous reasons the venture was not a success, and the Avonmouth works were never used. Now British interests are making another determined effort to get this trade established in this country, and the issue of these debentures is the first step in that direction. Messrs. Baldwins are largely interested in the undertaking. The British Government has arranged to supply the Broken Hill concentrates for about seven years, and other important supplies have been secured. There is thus a likelihood of preserving the industry for which the Avonmouth works were established, and which is of great importance to this country.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

ALLOYS.—The influence of casting temperature on aluminium alloys. F. H. Hurren. *Metal Ind. (Lond.)*, January 25, 1924, pp. 77–81. Shows that the physical properties of these alloys are better the lower the temperature.

ZINC.—The electrolytic production of zinc. W. Palmaer and A. Wejnarth. *Z. Elektrochem*, December, 1923, pp. 557–570 (in German). Discusses the principles, the wasting and leaching of the ores, the importance of purifying the resulting solutions, colloid additions to the electrolyte, the zinc precipitate formed, the variation of the potential during the electrolysis, and the economic aspect of the subject.

CORROSION.—Atmospheric corrosion of metals. W. H. J. Vernon. *Metal Ind. (Lond.)*; Part I, January 4, 1924, pp. 7–8; Part II, January 11, 1924, pp. 29–31. An important study of tarnishing phenomena in the case of various metals.

STEEL.—The heat treatment of mild steel. R. T. Rolfe. *Metal Ind. (Lond.)*; Part I, January 4, 1924, pp. 9–10; Part II, January 11, 1924, pp. 33–34; Part III, January 18, 1924, pp. 57–59. An article dealing with first principles and intended primarily for the engineer; some of the examples, however, are of practical interest to the metallurgist.

Investigations of the tempering of very mild steel at high temperatures. M. Sauvageot and H. Delmas. *Rev. Métallurgie*, December, 1923, pp. 777–795 (in French). Demonstrates the possibility of tempering steel containing less than 0·1 per cent. carbon at temperatures of about 1450° C.

Salt baths and containers for hardening. S. Tour. *Trans. Amer. Soc. Steel Treating*, January, 1924, pp. 7–19. Discusses in detail the subject of salt baths and the decarburising effects of chloride salt baths; a simple method of desulphurising a salt bath is given.

COBALT.—The industrial utility of cobalt. F. H. Mason. *Chem. Met. Eng.*, December 24, 1923, pp. 1135–1137. Summarises its properties, describes electro-plating experiments made with it, and refers to its alloys with iron and steel.

ANALYSIS.—The volumetric estimation of vanadium in steel. A. T. Etheridge. *Analyst*, December, 1923, pp. 588–590. Titration with permanganate using diphenyl-carbazide as indicator.

The determination of manganese. Part I. A study of the bismuthate method. T. R. Cunningham and R. W. Coltman. *J. Ind. Eng. Chem.*, January, 1924, pp. 58–63. Analytical procedures for the estimation of manganese in manganese ores, ferro-manganese and manganese metal by this method are given.

Qualitative steel analysis. Part II. Manganese. A. Kropf. *Z. angew. Chem.*, December 24, 1923, pp. 611–613. (in German). Describes the silver nitrate-persulphate, chlorate and permanganate methods.

New volumetric method for the estimation of sulphur in iron and steel. H. Pinsl. *Stahl u. Eisen*, January 17, 1924, pp. 72–74 (in German). Oxidation of the sulphur with permanganate in alkaline solution.

FOUNDRIES.—Electrification of the foundry. L. P. Egan. *Blast Furnace and Steel Plant*, December, 1923, pp. 587–604. Contains a comprehensive summary of the details relating to a complete operating unit.

GENERAL.—The strength properties of wrought iron, mild steel and nickel steel at high temperatures. H. Carrington. *Engineering*, January 18, 1924, pp. 69–71. Indicates that a steel, for instance, may be up to specification at normal temperatures but fall below it when in contact with superheated steam.

ELECTRO-PLATING.—Studies in electro-plating. Part I. The electron theory and electro:-plating. W. E. Hughes. *Metal Ind. (Lond.)*, January 18, 1924, pp. 49–52; and January 25, 1924, pp. 73–76. Theory and principles are discussed in these preliminary articles.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

BESSEMER (HENRY) AND CO., LTD., Sheffield, steel manufacturers. Registered January 7, £60,000 debentures; general charge. *£40,000. March 21, 1923.

BOOTH BROTHERS (DIAL FOUNDRY), LTD., Stourbridge. Registered December 24, £400 debenture to G. E. Booth, Platts Crescent, Amblecote, ironfounder; general charge (subject to existing charge). *£2,100. December 31, 1922.

CARDIFF IRONWORKS CO., LTD. Registered December 18, £3,000 debenture to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge.

COOPER AND HALL, LTD., London, E.C., steel manufacturers. Registered January 11, £1,500 debentures; general charge.

DANKS (ALFRED), LTD., Gloucester, ironfounders. Registered, December 24, £3,000 debentures, part of £50,000; general charge. *£14,000. April 25, 1922.

EARL OF DUDLEY'S ROUND OAK WORKS, LTD., Brierley Hill, iron manufacturers. Registered December 29, £600,000 debenture stock with premium of 3 per cent. (secured by Trust Deed dated December 20, 1923); charged on Round Oak Iron and Steel Works, Brierley Hill, and other properties, certain shares and debentures and a life policy, also general charge. *£30,700. September 11, 1923.

HALSTEAD (HENRY) AND SONS, LTD., Blackburn, ironfounders. Registered December 21, £10,000 debentures; general charge. *£10,000. January 8, 1923.

HENDY HEMATITE IRON ORE CO., LTD., Pontypridd. Registered January 3, £6,000 debentures (filed under sec. 93 (3) of the Companies (Consolidation) Act, 1908), present issue £3,859; general charge. *£939 15s. being 5s. in the £ on £3,759 debentures. April 26, 1923.

LUTON IRON FOUNDRY CO., LTD. Registered January 1, £1,000 debenture to Sir F. Beauchamp, Woodborough Hall, near Bath; general charge (subject to existing charge). *£7,000. June 6, 1923.

MILLS (S.) AND CO., LTD, Birmingham, brassfounders. Registered January 1, £3,000 (not exceeding) debenture to bank; general charge. *Nil. October 10, 1922.

UNION FOUNDRY CO. (BURNLEY), LTD. Registered December 19, £500 first debenture to J. Kippax, 34, Belvedere Road, Burnley; general charge (subject to a mortgage). *Nil, but a floating charge issued. October 22, 1923.

WEST CENTRAL ALUMINIUM FOUNDRY, LTD., London, E.C. Registered December 19, £880 debenture to T. B. Burnham, Villa Sans Gene, Nardelot; general charge. *——. December 31, 1922.

Satisfactions

BESSEMER (HENRY) AND CO., LTD., Sheffield, steel manufacturers. Satisfaction registered January 14, £40,000, registered July 5, 1910.

HALSTEAD (HENRY) AND SONS, LTD., Blackburn, ironfounders. Satisfaction registered December 21, £10,000, registered July 8, 1919.

NEW WESTBURY IRON CO., LTD. Satisfaction registered January 1, £5,650, balance of amount registered July 2, 1906.

PARRAMORE (F.) AND SONS, LTD., Chapeltown, ironfounders. Satisfaction registered December 28, £600 (not exceeding), registered August 16, 1911.

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor. THE CHEMICAL AGE, 8, *Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

Waste Heat and Oxygen Production

WE have always contended that some day the problem associated with the utilisation of oxygen in bulk for industrial purposes will be disentangled, and probably no one stands to profit more from such a development than does the metallurgist. From time to time one meets with proposals and inventions, all of which seem to take us a stage nearer the goal, but progress must necessarily be slow, for so much time must obviously elapse between the first stage of suggestion and ultimate translation to an industrial scale. It seems unlikely that we shall ever be able to produce oxygen so cheaply that it could be used entirely in lieu of air, but there is no reason why it should not ultimately be procurable at a figure which would permit of its use as an enricher. We notice that recently in Germany a patent has been granted, according to which the inventor claims that if enriched air is employed the products of combustion leave the furnace at a temperature sufficiently high to generate by means of waste-heat boilers more than sufficient power to supply the oxygen required for enrichment. The statement is backed up by an elaborate series of figures, which we are unable to repeat here but which have the appearance of being pretty well in conformity with facts. Put briefly, an oxygen plant of the Claude liquefaction type requires 34 h.p. per 1,000 cu. ft. of oxygen, and, using a modern turbine, 25,000 cu. ft. of oxygen require about 8,300 lb. of steam. It is shown, however, that with a 100-ton open-hearth furnace using enriched air there is a balance of heat sufficient to give 10,000 lb. of steam, so that the excess power obtained from the waste-heat boilers (by using enriched air without recuperation) is ample for the production of the oxygen required for enrichment.

The Relation of Physics to Chemistry

IT is twenty-five years since the discovery of radium was communicated by the Curies to the French Academy of Science. That discovery may be said to have revolutionised the basis of chemistry, yet its direct repercussion on chemical technology and practice has been comparatively insignificant. During the years that have elapsed, physicists have, so to speak, oriented themselves, and have not only assimilated the results of the discovery in question, but have developed them into a coherent whole, co-ordinating into a vast and harmonic system the progress made by the sectional departments of optical, electrical and mechanical research, and utilising in that process every contribution made by the chemist. While chemical technology has steadily progressed and applied chemistry has been fruitful of results, chemistry has remained, during the last twenty-five years, more or less empirical, in the sense that chemists have borrowed from the physicists, and while improving their own technology have contributed comparatively little original research work of a basal character so far as the fundamentals of chemistry are concerned. Practically all that has been done in the way of throwing light upon the actual nature of matter and its modes of action has been done by the physicist. The explanation is to be sought in the fact that the physicist is, perhaps first and foremost, a mathematician, while the chemist is, but too often, only a chemist.

The chemist or the metallurgist in a modern iron and steel works is a very busy man. The supervision of routine work of an important yet montonous description absorbs a very large proportion of his energies. Moreover, he is, in many instances, a man of comparatively middle age, and has often—be it whispered ever so softly—not had, in his youth, that "scientific training" which provides the proper foundation for the assimilation and co-ordination of fresh facts and new theories. Now that the physicist has invaded and illuminated the field of metallurgy the chemist is beginning to feel his deficiencies, it is often beyond his ability to grasp the elements of the new reasoning, or to appreciate the grounds upon which the new and somewhat bewildering theories are based. It is in this sense that his own science tends to become empirical, and he is compelled to rely upon results the causes of which remain obscure to him and the application of which he is unable wholly to grasp. He is in danger of becoming a mere listener-in, able to use a complicated apparatus but knowing very little of how and why it works, when it works well, or of how to repair or modify it if it works badly, because of his imperfect grasp of the scientific laws which underlie it. This knowledge he is urgently in need of, yet lacks; the tide of discovery bids fair to overwhelm him, and the admitted "chemistry tangle" is one which he is unable to unravel. He must either go to school again and devote the greater part of his studies to pure mathematics, or rest content with taking his theory at second-hand and shaping his practice as best he can. His handicap clings to him like a garment; he belongs to an older school of thought, and must either resign himself to the prospect of becoming out-of-date or begin all over again.

Indebtedness of Metallurgy to Physics

THE gifts of physics to metallurgy are daily becoming more and more valuable. The crystal-structure of metals deduced from the application of X-rays will throw fresh light on many questions which have, in the immediate past, vexed the soul of the metallurgist.

The problems of allotropy, of plastic deformation, of the strength of materials, and of the methods and condition of testing will one by one become resolved, with the most immediate and practical results on methods of manufacture, and on the mechanical and heat treatment required to develop the most valuable properties of the metals and of their alloys. In all these precious contributions to the progress of metallurgy the physicist plays the predominating part; it is he who investigates causes, and the chemist becomes a mere vehicle for the transmission of workshop recipes. It is not to be wondered at that, in the circumstances, the attitude of the physicist to the metallurgist is somewhat patronising. It is that of the rich relation to the poor relation, a poor relation given, moreover, to the habit of sponging. This attitude is apt to irritate the metallurgist, but what can he do? He cannot dig and is apparently not ashamed to beg. It is but too true that, as Dr. Jeans said some years ago, in a lecture to the Chemical Society on the quantum theory, the chemist and the mathematician are too far apart. His conclusion is worthy of reproduction: "If once chemistry becomes a mathematical science it may progress at a rate at present undreamed of." Even in the short space of time which has elapsed since this lecture was delivered, chemistry *has* become a mathematical science. The metallurgist must go back to school and learn mathematics.

Metal Mixer Practice and Basic Steel Making

By T. P. Colclough, M.Sc., B.Met.

In these days it is essential that each detail in the process of steel-making should be subjected to a close examination in order to determine at which points improvements, with resulting economies, can be made. In view of increasing competition, from both home and foreign sources, it is imperative that every possibility of decreasing costs and increasing output, while at the same time maintaining the highest standard of quality, shall be explored.

In no branch of the steel industry is the question of output and working costs more urgent than in basic steel-making. In the manufacture of basic steel one of the most important units of the plant is the metal mixer. In those plants operating the Talbot and similar processes it is *essential* to have a constant supply of liquid pig iron available, and, in modern practice, an increasing proportion of "fixed" furnaces are being operated with liquid iron as opposed to cold pig iron. A study of the functions and possibilities of the metal mixer is, therefore, of value.

It is now some 45 years since the first metal mixers were installed in America and Germany. Prior to this the pig iron used in the Bessemer converters was taken direct from the blast furnaces or from cupolas in which the iron was remelted. In open hearth furnaces this method has great disadvantages; first, there is difficulty in synchronising the tapping of the blast furnaces with the charging of the open hearth, with consequent delays; second, the great variations in quality of the pig iron make it very difficult to charge the correct amounts of limestone and iron ore to deal adequately with that metal. As a result, either difficulty is experienced in melting, due to excess of lime and ore, or if lime be deficient, damage is done to the furnace banks by the siliceous slag formed. The advantages derived from the use of the mixer may be summarised as follows:—

(1) Economy of fuel; (2) simplification of charging of the open hearth; (3) reduction of costs by purification of pig iron resulting in: (*a*) quicker working; (*b*) decreased consumption of limestone and iron ore.

Economy of Fuel

The true comparison of the use of hot and cold pig iron from the point of view of fuel economy is somewhat complicated because various factors must be considered. First, the amount of coal necessary to maintain the supply of metal in the mixer must be compared with that necessary to produce metal in the open hearth furnace at the same temperature from cold pig. Mr. F. Clements in his recent papers on open hearth practice* gives the following data:—

(*a*)	Temperature of hot metal from mixer ..	1,300° C.
	Heat required to raise pig iron to m.pt. (1,150° C.)	Per lb. 142 C.H.U.'s
	Heat required to melt pig iron	59 C.H.U.'s
	Heat required to raise liquid iron to 1,300° C.	30 C.H.U.'s
	Total heat required = 231 C.H.U.'s per lb. = $5{\cdot}17 \times 10^5$ C.H.U.'s per ton.	
(*b*)	Taking coal of calorific value ..	7,640 C.H.U.'s
	"Hot Gas Efficiency" of producers	91 per cent.
	Efficiency of open hearth furnace	17 per cent.
	1 lb. of coal gives 1,182 C.H.U.'s imparted to metal.	
	∴ Coal required in O.H. = 437 lbs. = 3·9 cwt. per ton of pig iron.	

Against this coal consumption in the open hearth furnace the coal required in a 400-ton mixer varies from 0·75 cwt. per ton with a through-put of 2,000 tons per week, to 1·75 cwt. per ton with a through-put of 1,000 tons per week. There is, therefore, from this factor alone a saving of 2–3 cwt. of coal per ton of iron used to be effected by the use of the metal mixer. The economy is still greater if, as is done in many cases, the mixer furnace is fired by waste gases from the blast furnaces.

In addition to the above economy other factors bring additional saving of fuel. In the first place, the pig iron being already liquid and hot, the working of the furnace is quickened, and larger outputs per week being obtained from the same consumption of fuel, it follows that the week-end, etc., losses per ton are correspondingly reduced. Also, since the composition of the iron from the mixer is known, the correct amounts of "feed" can be charged with, consequently, less danger to the banks of the furnace, and hence the time and heat losses for "fettling" at the end of each heat are reduced. Further, as will be shown later, the purer metal obtained from the mixer requires a much smaller weight of slag in the open hearth furnace. This operates in two ways: there is a much smaller weight of material to heat, and the slag, having a smaller thickness, permits heat from the flame to pass through it to the metal much more quickly than in the heavy thick slags when using cold pig iron. All these factors tend to give quicker working and a saving of fuel.

* J.I.S.I. 1922 and 1923.

Purification of Metal

The first metal mixers were used simply as storage reservoirs to maintain the supply of liquid iron necessary for the steel furnaces. In modern practice they are largely used as preliminary refining furnaces, limestone, and oxide of iron, in the form of iron ore or tap cinder, being charged as required. In this way, in addition to producing a pig iron of fairly constant composition by merely mixing the various casts of iron, a large proportion of the impurities is removed. The elements affected in the mixer are silicon, sulphur, and manganese, the carbon and phosphorus contents remaining practically unaltered. The effects of this purification of the pig iron on the operation of the open hearth furnaces may be considered in detail.

Silicon

The silicon of the pig iron is *the* element which is the ruling factor of the slag, the aim, in present practice, being to form a slag with about 12 per cent. or less of SiO_2. From this it follows that if the silicon of the iron can be reduced to 0·5 per cent. instead of 1 per cent. or more there is a marked economy in several directions. Silicon is the first element in the iron to be oxidised, and the whole of it, forming SiO_2, passes into the slag, to which the limestone necessary to combine with it must be added. The lower the silicon content of the iron the less is the weight of iron ore necessary to oxidise it, and, also, the less is the weight of limestone required to form a suitable slag. Since each lb. of silicon requires, theoretically, about 7 lb. of iron ore to oxidise it, and about $7\frac{1}{2}$ lb. of limestone to furnish the CaO to combine with the SiO_2 formed, the elimination of over 50 per cent. of the silicon in the mixer means a considerable economy in the working of the open hearth furnace.

Further, in the manufacture of basic steel the slag formed is a valuable by-product because of its use as a fertiliser. The value of this slag depends primarily on its phosphate content. In the mixer, oxidation is never carried to the point at which the elimination of phosphorus begins, hence the whole of the phosphorus of the iron passes to the open hearth furnaces. In the steel furnace the phosphorus content of the metal is reduced to 0·05 per cent. or less, the phosphorus, oxidised to P_2O_5, passing into the slag where it combines with CaO to form the tetra-calcic phosphate 4 CaO. P_2O_5.

Since the amount of phosphorus in the pig iron is strictly regulated, the amount of P_2O_5 formed is regulated also, and the phosphate content of the slag will depend upon the weight of slag carried in the steel furnace, and this, in turn, is regulated by the silicon content of the iron. Hence by the removal of silicon from the iron in the mixer there results, in the open hearth: (1) A decreased consumption of iron ore and limestone; (2) a decreased weight of slag, giving a higher market value because of its increased phosphate content; (3) a decreased fuel consumption because of decreased weight of slag.

Sulphur

The makers of basic steel demand a pig iron with as low a silicon content as possible. This, in these days of high production, often means that the blast furnace is operated with a slag "lean" in lime, and as a result the iron made tends to be high in sulphur, running 0·05–0·08 per cent. or higher. In spite of this, high grade basic steel, with sulphur content 0·04 per cent. or lower, can readily be made owing to the ease with which the sulphur can be removed. Two methods are available. In one, perfected by Saniter and others, fluor spar is added to the slag in the open hearth furnace. This, giving a greater fluidity to the slag, enables a much higher lime content to be carried—50/55 per cent. CaO as against 38/42 per cent. in ordinary slag—and this, according to the latest work*, sets free manganese, which acts as a de-sulphuriser.

This method, while quite effective, suffers from several disadvantages and increases the cost of the steel. In addition to the cost of the fluor spar, considerably more—about 20/25 per cent.—limestone is required to form the necessary slag. This reacts in several ways: (*a*) Heat is absorbed by the heating of this extra limestone and also in its decomposition to CaO and CO_2. Further, the slag formed is thicker than a non-spar slag, and offers a greater resistance to the transfer of heat from the flame to the metal. There is, therefore, a greater expenditure of fuel. (*b*) In general, a higher prevailing temperature must be maintained in the furnace using spar slags than with normal slags, and there is a consequent greater wear on the walls and blocks of the furnace. (*c*) The slag formed is not so valuable as a by-product because of its greater weight, and therefore lower phosphate content. Also, one of the tests applied to basic slag used as a fertiliser is its solubility in a 2 per cent. solution of citric acid. In some way, probably due to the P_2O_5 forming a double compound of calcium phosphate and fluoride, the citric acid solubility of spar slags is far below that of ordinary basic slag. As a result the commercial value of the slag almost entirely disappears. These factors, in their cumulative effect, exercise a marked influence on the cost of steel-making.

The alternative method of removing sulphur is to do so in the mixer. It is based on the discovery of Massenez that manganese added to pig iron combines with the sulphur to form manganese sulphide. This sulphide being, in all probability, insoluble in pig iron at the prevailing temperature, slowly liquates and rises to the surface of the iron, passing into the slag layer. Here it is oxidised by the air or furnace gases forming SO_2 which escapes, and MnO which remains in the slag. To bring about this change the iron is manufactured with a manganese content of 1½–2 per cent. No action, apart from maintaining the fluidity of the metal, is necessary, the operation being dependent on time only for the separation of the MnS. This practice is now followed by most firms where the steel works and blast furnaces are in conjunction in one plant, and involves none of the disadvantages resulting from the use of spar.

As a result of the combined reduction of silicon and sulphur content in the mixer the iron produced is almost ideal for basic practice.

Importance of Manganese Content

As pointed out above, the elimination of sulphur in the mixer demands a manganese content of 1·5–2 per cent. in the pig iron. As will be seen from Table I., British iron stones are low in manganous oxide, and the mixture used in the blast furnaces gives, as a rule, about 0·7 to 1 per cent. only of manganese in the iron. It is necessary, therefore, to add manganese oxide in some form to the "burden" of the blast furnace. Usually the slag from ferro-manganese furnaces, containing 18–25 per cent. MnO, is used. In ordinary practice almost the whole of this manganese is lost. A small proportion is eliminated in the mixer, passing into the slag as MnO, the remainder, about 1·5 per cent., passing with the metal to the open hearth furnaces. Here the manganese is oxidised—again yielding MnO which is of no value—the amount of manganese in the bath at tapping being about 0·15 per cent. In works producing large quantities of steel this loss of manganese is an important item, and in the last two or three years the process has been modified to avoid the loss. It is found that, by a careful control of the temperature and feeding of the mixer furnace, it is possible to reduce the manganese in the mixer metal to 0·7–0·8 per cent.—*i.e.*, to the percentage given to the pig iron by the normal mixture of British iron stones.

The manganese thus oxidised gives a slag in the mixer with a MnO content of 16–22 per cent. (see Table II.)—*i.e.*, equal in value to that from the ferro-manganese furnaces. This slag is returned to the blast furnaces, and in suitable proportions used to furnish the required manganese in the iron. In this way a self-supporting manganese cycle, from blast furnace to mixer and back, is established, no manganese additions are required for sulphur removal, and a considerable economy is effected.

In addition, this slag performs a very useful function as "lubricant" in the blast furnace. With the fast driving and narrow limits of "burdening" of modern practice there is constant danger of trouble with "scaffolding," etc.; this mixer slag has a low fusion point and facilitates the early formation of a fluid slag, and thus tends to easier and more regular working of the blast furnace.

From the foregoing it will be seen that the mixer furnace, from being a minor and subsidiary item in the equipment of a basic steel plant, has developed into one of the most important and valuable factors in the process of steel-making; for its maximum efficiency and economical working careful chemical control is of first-rate importance.

TABLE I.

Analysis of British Ironstones.

	A.	B.	C.	D.	E.
	%	%	%	%	%
SiO_2	14·7	7·2	17·2	14·6	11·2
Fe	24·8	22·0	20·2	33·4	22·8
Mn	0·55	0·97	0·27	0·33	0·27
P	0·29	0·28	0·32	0·58	0·25
CaO	10·2	19·6	12·7	2·2	15·0
Moisture	15·0	14·8	11·3	14·6	12·4

TABLE II.

Mixer Slags.

	Without Mn Recovery.		With Mn Recovery.
	%		%
SiO_2	34·0	..	30·0
CaO	37·0	..	33·3
MnO	7·74	..	19·4
Fe	5·5	..	5·2

* Colclough. J.I.S.I., i. 1923.

Iron and Steel Production Figures

THE iron and steel production figures for the year 1923, and comparison with the pre-war period, are very interesting. The following particulars show the comparison:—

Pig iron produced.	Tons.
1913	10,260,300
1922	4,902,300
1923	7,438,500
Steel ingots and castings produced.	**Tons.**
1913	7,663,876
1922	5,880,600
1923	8,488,900

It will be seen that the pig iron output is considerably below the pre-war figures, whilst the output of steel is about one million tons in excess. Up to 1916 the output of pig iron had been in excess of steel, and in those years a much larger quantity of pig iron was exported than is done to-day. On the other hand, the exports of steel have increased to an almost equal extent, as the following figures show:—

Iron and steel exports.	Tons.
1913	4,969,224
1922	3,401,115
1923	4,400,000

In the export of iron and steel Britain holds the lead in the world's trade, a position which must be regarded as very satisfactory, in view of our dependence on export trade.

Although the steel output was much in excess of the pre-war year, it must be borne in mind that the productive capacity of the country was greatly increased during the war, and we shall need to have a much larger total output before the works can be said to be fully employed.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

Heat Treatment of Steel

THE overwhelming importance of correct heat treatment is apt to be regarded by many so-called practical men as grossly exaggerated. It is true that in regard to grades of what may be called "straight carbon steels" the wealth of accumulated empirical experience may, for all practical purposes, constitute a safe method for attaining the requisite results from the material under consideration. Such steels are comparatively simple in constitution, and the relative structures corresponding with varying percentages of carbon are such that methods of heat treatment based on experience alone may, and do, yield results equal to those obtained by more scientific and reasoned methods. It is, however, another matter entirely in regard to ternary steels, and becomes still more complicated when quaternary steels are in question. In such materials, to many of which, according to Professor Arnold, the word steel is inaccurately applied, the correct mode of manufacture is naturally of fundamental importance, yet such alloys cannot develop the qualities upon which their useful applications depend unless they undergo special and individual heat treatments, scientifically carried out within definite and often restricted ranges. The least overheating or the least underheating, too rapid cooling or too slow, and the intrinsic qualities for which they are valued will be found to have been destroyed or deteriorated, often to the extent of rendering them commercially valueless for any purpose whatsoever. A special steel may, on the other hand, possess valuable specific qualities, rendering it applicable, within a comparatively wide range of heat treatment, for a number of general purposes, and yet develop within a narrower, or different range of treatment, some one or more special qualities which can only be brought out by that treatment. The manufacturer, who is naturally interested in the correct heat treatment necessary to do justice to his product, is generally the best judge of what heat treatment should be given it. An instance to the contrary, and one of the greatest interest in this connection, has recently been afforded by the stainless steel controversy which has, during the last month, aroused such deep interest in Sheffield and its vicinity.

The New Dutch Blast Furnaces

IT is notorious that the productive capacity of European countries for iron and steel is greatly in excess of any demand which even the most optimistic can hope for in the near future. In the circumstances it is doubtful whether the British iron trade is likely to enthuse over the blowing-in of the new blast furnace at Ymuiden, Holland, in the last week in January. There are, however, features of this new plant which will be of interest to all metallurgists, and some of the considerations which have led to the erection of a new ironworks in Holland are worthy of closer examination. The Dutch ports of Amsterdam and Rotterdam have, for many years past, been handling heavy tonnages of iron ore, coal, and manufactured products of iron and steel, in transit to other countries. The assemblage at these ports not only of the raw materials of the industry but of large tonnages of pig iron have very naturally inspired Dutch business men with the notion that a proportion at least of such raw materials might economically and advantageously be intercepted *in situ*, and profitably dealt with in their own country. Ymuiden is conveniently situated at the mouth of the Amsterdam Canal and possesses a deep sea harbour. The site of the new works is only a little over two miles from the end of the piers, and there is accommodation seawards for vessels of all sizes, while Rhine Canal boats of 1,500 tons capacity can reach the locality from the canal side, and the railway facilities are considerable. The home consumption of pig iron is large, there being no other blast furnace plant in Holland. Small wonder therefore that home capital should have been attracted to the scheme.

The Royal Netherlands Plant

THE new plant consists of two thoroughly modern blast furnaces fitted with the very latest improvements and modifications. The daily capacity of each furnace will be 300 tons of pig iron, and, as mentioned above, one is already in blast. The furnaces have been designed and built under the supervision of the firm of Freyn, Brassert and Co., of Chicago and London, and their lines are more in accordance with American practice than with that usually in vogue in this country or on the continent. Skip hoisting has been adopted, and the furnace tops are of the familiar M'Kee type with double bells and mechanical distribution. The charge will consist of a mixture of Spanish, North African, Swedish and French ores, and extensive ore bunker capacity has been provided so as to enable some selection to be exercised with a view to securing that most important of all factors in successful blast furnace working, uniformity in composition and physical conditions of the ore burthen. Each furnace has its own battery of three Cowper stoves, and three turbo-blowers have been installed to provide the blast. The plant will make its own coke from foreign coal supplies, and a battery of Coppee coke ovens has been built together with a complete by-product recovery plant.

An Interesting Experiment

SHOULD the new enterprise justify expectations a steel works and rolling mills will be added. At present the intention is to make basic pig iron and foundry descriptions, and to supply the home market. The offices of the undertaking are at the Hague, and the paid-up capital is 30,000,000 gulders, approximately equivalent to £2,700,000. It is of great interest to note that of this capital not far short of one-half is jointly the property of the Dutch Government and of the City of Amsterdam. The semi-Socialisation of such "means of production" (for that is what it amounts to) may be feasible in a case like this, where the "means" in question are the only ones in existence, as the prospective pig iron will not be in competition with other brands made in the same country, there being no other blast furnaces in Holland. Should any others be established at any future time, it will be interesting to see how the economic conduct and management of this partly State-aided enterprise will compare with them. At present it has the field to itself.

Pure Aluminium from an Alloy

A PROCESS has been patented by the Aluminium Co. of America, Pittsburg, U.S.A., for obtaining pure aluminium from an alloy. The process is carried out in an electrolytic furnace using a fused electrolyte having a higher density than aluminium but a smaller density than the alloy, and a selective action in dissolving the aluminium from the alloy. A layer of the electrolyte is covered by a layer of molten aluminium. The electrolyte must not contain more than 7 per cent. of alumina, but must be capable of dissolving a considerable amount of alumina. The electrolyte should have a density of 2·4 to 3·1 at a temperature of 1,000° C., and may consist of aluminium and sodium fluorides with about 20–60 per cent. of barium or strontium fluoride, but no chlorides, and not more than 2 per cent. of fluorides of alkaline earth metals of lower atomic weight. Saturation of the electrolyte with alumina is prevented by auxiliary electrolysis with carbon anodes from time to time, or simultaneously with the main electrolysis. Aluminium is deposited in the aluminium layer, or in this and the alloy, according to the voltage of the auxiliary anodes. The alumina may alternatively be reduced by removing part of the electrolyte and replacing it with fresh fluorides. The process can be applied to an alloy containing 25 per cent. of copper, which has a density of 2·8 at 950° C. Silicon may be present in the proportion of 2–32 per cent. of the copper-silicon content. Such an alloy may be obtained from materials containing alumina by smelting them to produce an aluminous slag, smelting the slag with copper to produce an aluminium alloy, and then refining the alloy as described above. Aluminium containing not more than 0·1 per cent. of impurities may be obtained by this process, and the metal has a high degree of softness, ductility, malleability, and strength, and a high resistance to attack by acids. A suitable electrolytic furnace for carrying out this process, and full details for the method of working it, are given in a series of patent applications Nos. 208,710-1-2-3-4-5-6-7, bearing the International Convention date December 21, 1922.

Treatment of Lead-zinc Sulphide Ores, Etc.

A PROCESS for treating lead-zinc sulphide ores, concentrates, and mattes to obtain a melt of lead chloride suitable for electrolysis has been patented by A. E. Ashcroft, of London. The process is more particularly for treating materials in which the lead predominates over the zinc to an extent which would render impracticable the decantation of fused zinc chloride from the lead-iron precipitate. The metalliferous material is chlorinated at 600°–700° C., and the liberated sulphur is condensed and recovered. The mixture of chlorides is then treated with cold water or zinc chloride solution to dissolve out the zinc and iron chlorides, leaving lead and silver chlorides. The latter are fused and electrolysed for the recovery of the metals, while the chlorine is used again for the chlorination of fresh raw material. The sulphur liberated during the chlorination is preferably condensed on the surface of a strong solution of zinc and iron chloride obtained by the extraction by water as above. Any of the zinc chloride distilled over is dissolved in the solution, and the sulphur is condensed as a floating layer, which may be removed. The concentrated chloride solution which accumulates may be removed periodically and added to the zinc concentrates. The fused lead chloride may be electrolysed in two stages, in the first of which the silver with a small proportion of lead is deposited, and in the second of which lead of a high degree of purity is deposited. The chlorination temperature is preferably about 600–700° C., and in the subsequent stages in which molten chlorides are treated the temperature is preferably 400°–450° C. The mixture of metallic chlorides is preferably extracted in three stages, first with strong crude zinc chloride solution, then with weaker solution, and finally with water. These liquors may then be used in the treatment of further quantities of the mixed chlorides. The electrolysis of the lead and silver chlorides is preferably conducted in a multiple couple electrolyser, as described in specifications 198,024 and 208,649 (see THE CHEMICAL AGE, Vol. VIII., p. 706, and Vol. X., p. 100), and the proportion of iron, copper, etc., in it should not exceed 0·1 per cent. of each. It is found that the electrolysis is facilitated by the presence of 1–5 per cent. of manganese chloride, which may be added if not already present. See Patent No. 210,011, dated June 2, 1923.

Research in Molybdenum Steels

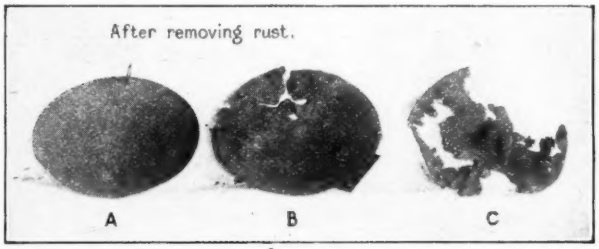
SOME interesting experiments have recently been carried out by the Studebaker Co. on the use of molybdenum steels in the manufacture of motor car parts. Altogether about 2,000 tons of this steel of various mixtures have been used in 50,000 cars for transmission gears and shafts, rear axle shafts, steering knuckles and pins and driving pinions. One result of these experiments was that a steel of 0·30 to 0·40 per cent. molybdenum, 1 per cent. chromium, and over 0·30 per cent. carbon, is not suitable for water quenching because of the formation of cracks; whereas a steel of practically similar composition containing the same proportion of molybdenum, 0·70 to 0·90 per cent. chromium and 0·23 to 0·30 per cent. carbon, is perfectly satisfactory. Chrome molybdenum steels have proved of great value in automobile construction where heat treated parts are used. It will forge and machine well, and will cold shear as easily as other grades of steel. In addition, it is considerably cheaper than chrome vanadium steel. It is also very suitable for case-hardening gears.

As indicating the effect of slight differences in treatment of molybdenum steels, it might be mentioned that a steel of 0·37 per cent. molybdenum, 0·70 per cent. chromium, 0·025 per cent. phosphorus, 0·01 per cent. sulphur, 0·54 per cent. manganese and 0·19 per cent. carbon, when heated for case-hardening for three minutes at 1,425° D. in a lead pot, gave a satisfactory product when oil quenched. On the other hand, the same steel heated for four minutes, but otherwise treated in exactly the same manner, was found to be too brittle for any practical purpose. Compared with the usual chrome nickel steel, chrome molybdenum steel will case-harden to the same depth in 10 per cent. less time, and will also have an increased shore hardness.

As a result of these researches it seems likely that nickel molybdenum steel will be a formidable rival to chrome nickel steel for case-hardening important parts of automobiles. For instance, the Studebaker Co. use with great success for gears, knuckle pins and similar parts, a nickel molybdenum, 1·58 per cent. nickel, 0·02 per cent. phosphorus, 0·022 per cent. sulphur, 0·38 per cent. manganese and 0·13 per cent. carbon. This steel is found to be superior to chrome nickel steel for case-hardening on account of its property of hardening in oil in the hot-rolled condition after carbonising, and also because of its greater hardness.

Corrosion Tests.

FOLLOWING up the note by Mr. D. M. Strickland on the chemist's part in the control of commercially pure iron, the accompanying illustration shows the results of a practical laboratory test in corrosion. The saucer-shaped receptacles were originally identical in size and gauge. These saucers were filled with locomotive cinders saturated with three per cent. sodium chloride (common salt) solution. The contents of the saucers were kept moist by the addition of distilled water. The test was conducted for 157 days, the testing conditions being exactly the same for all specimens. The marked differences in corrosion resisting properties are apparent. Saucer "A" is Armco ingot iron, whereas saucer "B" is charcoal iron and saucer "C" is common steel. This test simulates many everyday uses of ferrous metals and shows the sturdy resistance of ingot iron to salt water and moist cinders.



A New Steel Resistant to Corrosion

M. R. STUMPER* has investigated the resistance of nickel-chrome steels to chemical agents and has published interesting results on a steel of the following composition: Silicon, 0·54 per cent.; Phosphorus, 0·012 per cent.; Manganese, 0·65 per cent.; Carbon, 0·60 per cent.; Chromium, 15·68 per cent.; Nickel, 7·04 per cent.

Samples of this material were submitted to the influence of chemical agents of various kinds, and for comparative purposes similar tests were made on samples of Thomas steel. Qualitative tests showed that the special steel was not attacked in nitric acid, and was not affected by humid air at ordinary temperatures. The experiments showed that the special steel was remarkably resistant to chemical agents of the most varied kinds. Tests were made to ascertain its corrodibility under the influence of electric currents. Contact with copper increased the corrosion of the ordinary steel by 500 per cent. and the current passed through the electrolyte from the iron to the copper. With the nickel-chrome steel in contact with copper, the current carried the copper to the steel, from which it was concluded that the steel was more electropositive than the copper. From this it was anticipated that contact with copper would not influence the corrosion of the special steel, which was found by experiment to be the case. On the other hand, the corrosion of iron in galvanic contact with the nickel-chrome steel was accelerated. It was also found by experiment that the corrosion of the Thomas steel was increased by 185 to 210 per cent. when in contact with the special steel in an electrolyte of moderate conductivity. In practice, such contact must be avoided, particularly in the presence of good electrolytes.

Corroding Medium	Time.	Temp.	Loss by Corrosion. Special Steel.	Ordinary Steel.	Relative Special Steel.	Ordinary Steel.
1% HCl	40 hrs.	15–20°C.	0	0·2065 g.	0	100
5% ,,	,,	,,	0	0·7103	0	100
10% ,,	,,	,,	0·0269	0·500	5·6	100
20% ,,	7 hrs.	,,	0·0110	0·1105	10·1	100
1% H_2SO_4	6 days	,,	0	0·632	0	100
2% ,,	,,	,,	0	0·869	0	100
5% ,,	3 days	,,	0	3·840	0	100
10% ,,	,,	,,	0	5·672	0	100
20% ,,	1 day	,,	0·0024	5·303	0·5	100
1% NaCl	4 days	,,	0·0005	0·00232	20	100
3% ,,	5½ days	,,	0·0005	0·0432	1	100
Water Vapour and pure air	3 days	40–45°	0	0·335	0	100
Conductivity Water	1 day	18°	0	0·0115	0	100

* *Revue de Metallurgie*, Mémoires, Sept., 1923.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE fear that was manifested last month of the possible effects of a Labour Government has, after all, not been justified, and we no longer hear the lament of those who predicted a speedy disruption of the fabric of industry. The Labour Government is now an established fact, its leaders have outlined their policy, and we find that it departs very little from the lines laid down by their predecessors. What difference there is, apart from the Poplar decision, presages no harm; we may even hope for some betterment. At all events, another cloud has lifted.

Strike Threats

Unfortunately, however, the removal of this anxiety has soon been followed by the strike of the dockers, which, in the short time that it has lasted, has left its mark on trade. It has intensified the dislocation which still remained as a legacy of the railway strike. The pity of it is that the settlement arrived at is bound to be on lines which might just as well have been followed in the first stages of the dispute. The immediate effects of the strike on the iron and steel trade were seen in a stoppage of export deliveries and a consequent curtailment of production. But the great mischief is the disturbance of confidence, bringing a return to the hand-to-mouth policy, which is the only one consumers dare adopt in such unsettled conditions.

On top of all this there is the menace of a coal strike, which looms more largely than it did when we spoke of it last month. There is still time to prevent it, and it is most earnestly to be hoped that every avenue will be explored along which an agreement can be made so that we may be spared from this crowning blight on the industry.

In face of all the trouble that has been experienced in the past few weeks it is not surprising that the iron and steel trade shows no progress. On the other hand it has not declined to any great extent, although there has been more weakness in some sections than in others. The prevailing condition at present is one of quietness, and new business is not coming forward as the manufacturers had expected. The orders already in hand will keep the mills going for some little time, but they are not sufficient to ward off the uneasiness which the course of events is causing. If only it were possible to look forward to a period of settled industrial peace, then the iron and steel trade might make the progress which was in such good promise at the close of last year.

Continental Competition

Competition from the Continent is increasing. The prices at which foreign iron and steel are being offered in this country are so much below the home prices that it is useless to try to meet them. A difference of over £ 2 per ton gives the English maker no chance of getting orders where cheapness is the first consideration. Belgian billets are quoted at about £6 5s. and bars at under £8 per ton delivered, against the home quotations of £8 5s. and £10 10s. to £11 respectively. However, there are other considerations besides price. Even if the quality is assured, and that cannot always be relied on, deliveries are slow and irregular, and the constant fluctuation of the exchange causes would-be buyers to hesitate. The dockers' strike has been of some little advantage in this one respect, in that it has held up for a short time the import of foreign steel.

There seems to be no doubt that the French and the Germans are coming more and more into agreement on the question of production in the Ruhr, and while it is all to the good that there should be accord between the two countries, politically and economically, one definite result is that we shall have to face increased competition from that quarter. We understand that representations are already being made to the Government, on behalf of the iron and steel trades, in order that some policy may be formulated which will help the British manufacturers to meet this difficulty.

Still Grounds for Optimism

Notwithstanding the particular drawbacks with which the heavy industries are confronted there are grounds for optimism in the general situation. The appointment of a German Ambassador to Paris is a sign of a return to normal relations in Central Europe, for which the whole Continent has so long been waiting. The recognition of Russia's new rulers by our own Government is another step in the right direction. The closing of the Russian market has been a severe loss to this country, both directly and indirectly. The agricultural machine makers in Lincolnshire and further south have been deprived of a very important outlet for their productions, and they will be very glad of the chance to resume business there. This will not come suddenly, as the financial arrangements require careful consideration, but the way has been opened.

The decision of the Cabinet to lay down five cruisers and two destroyers is very welcome news. This will directly benefit the steel trade very considerably, and will further stimulate other branches of trade. The sooner the work is put in hand the better. It has been noticed in the past that the launching of a programme of naval construction by the Admiralty has been the beginning of a general revival in the steel trade, and although the present programme is not large it is to be hoped that the past experience will be confirmed.

In the meantime the railway companies are still placing orders which are of great assistance. A large part of the material required by the railways for the work being carried through in their own shops has still to be placed. The regular flow of these orders is enabling many works to carry on steadily. There is also more buying of heavy machinery, implements, etc., and a large volume of engineering construction work is being given out, requiring enormous quantities of iron and steel. Colliery developments, too, are proceeding, more than they have done at any time since the war. As already stated, if strife between employers and workmen on wages questions can only be avoided the future can be faced with confidence.

Market Conditions

Coming to the particular market conditions there is not much change to report, but what there is, unfortunately, is not an improvement. Pig iron is very quiet and prices have receded slightly. There is a feeling that quoted prices are somewhat nominal and would be shaded if good orders were offered, as the whole of the output is not being absorbed. Consumers are expecting a reduction, while makers feel that present prices ought to be maintained or even increased, in view of the certain increase in the cost of production. Coke prices will undoubtedly be advanced at the end of March, and quotations now being given indicate that this advance will be considerable. It is not surprising, therefore, that present buying of pig iron is confined to current needs, and that neither side is anxious to enter into forward contracts. The weakness is more pronounced in Middlesbrough and Scotland than elsewhere. Lincolnshire and Derbyshire prices are comparatively firm.

Manufactured iron is holding its own, and there is some increase in activity. The works are maintaining their outputs, largely by reason of the railway orders. The English prices have not altered. There is still a hopeless disparity between these and Belgian prices, but although many of the works are working on Belgian bars, the difficulty in obtaining deliveries has diverted orders to the English makers, and the demand seems to be improving.

Finished steel is quiet. Nominally the prices remain unchanged at £10 for sections and £10 10s. for plates, but the merchants with their earlier contracts are able to undersell these prices, and even the makers are accepting less. There are not many heavy plate orders about, but some works are taking them at £10 5s. The Scottish makers are competing keenly for orders in the Midlands, and with their heavy carriage are unquestionably selling at much under cost. In Lancashire particularly the steel trade is dull, and is likely to be so until the cotton industry improves. The two are closely related, and the conditions of the cotton trade are soon reflected in the steel market. The Small Bar Association maintains the prices fixed at the commencement, but reports show that

this price is being cut. It is the usual experience; in good times, when prices are on the up-grade the controlled minimum is safe, but when orders have to be sought for there are always makers to be found who are willing to sacrifice the control rather than the orders.

Steel billets are weaker in consequence of the keen foreign competition. The price of soft billets is round £8 5s. in the Midlands, and from £8 5s. to £8 10s. in Sheffield, as against £6 5s., or even less, for Belgian. The price of hard billets is unchanged. In sympathy with the price of billets scrap is also lower. Although merchants are trying to hold up to 95s. supplies can be bought freely for 92s. 6d., and manufacturers are now offering 90s.

Contracts

There have been some notable contracts given out in the past few weeks which are of interest to the steel trade. Chief of them is the construction of the North Shore Bridge at Sydney, at an estimated cost of £6,000,000. The tender of Dorman, Long and Co. has been recommended for acceptance. The Australian works are to be given the preference in the supply of the material. Altogether about 35,000 tons of steel are required.

Messrs. Armstrong, Whitworth and Co. have secured the contract for building a steel and concrete bridge over the river at Geelong, Victoria, at an estimated cost of £73,900. The Cleveland Bridge and Engineering Co. are to provide the steelwork for widening the Trent Bridge at Nottingham at a cost of £78,709.

The London Midland and Scottish Railway have ordered 200 steel hopper wagons of 50 tons capacity for carrying iron ore, the orders being divided among three prominent firms of wagon builders. This railway company has also ordered four large open hearth steel furnaces for Crewe from the Wellman, Smith, Owen Engineering Co.

The Durham County Council are ordering four new bridges at a cost of about £250,000. The North East Coast steel makers will benefit from this order.

Another interesting item is the placing of a contract by the Admiralty with Messrs. Cox and Danks for the raising of the German ships sunk at Scapa Flow. The progress of the salvage operations will be closely followed on account of the effect on the scrap market.

Medals for Australian Metallurgists

The gold medal of the Institution of Mining and Metallurgy (the premier distinction within the gift of the institution) has been awarded conjointly to Mr. Herbert William Gepp and Mr. Gilbert Rigg, in recognition of their services in the advancement of metallurgical science and practice, with special reference to their achievements in the treatment of complex sulphide ores, and in the development of the electrolytic process for the production of zinc in the Commonwealth of Australia.

Sponge Iron for Extraction of Lead

In the course of experimental work on the chloride roasting and acidulated brine leaching process performed by the United States Department of the Interior various refinements have been developed. A plant for treating silver precipitate has been nearly completed by a mine in the Tintic district. In order to save the lead which was being lost in such precipitates, a method was worked out in which sponge iron is used to precipitate all the lead dissolved. For making this sponge iron, the Bureau of Mines furnace developed at the Seattle station is employed.

Sulphate Roasting and Leaching of Complex Ores

An experimental roasting furnace has been designed and erected for work on combined leaching, concentration, and roasting processes by the United States Department of the Interior at the Salt Lake City experiment station of the Bureau of Mines. Experiments on the complex lead-zinc middling that is found difficult to market by most flotation plants handling ores of this class showed that the lead may be sulphated and removed by leaching. Further work is being done to determine whether the zinc in the residue may be leached.

Some Inventions of the Month

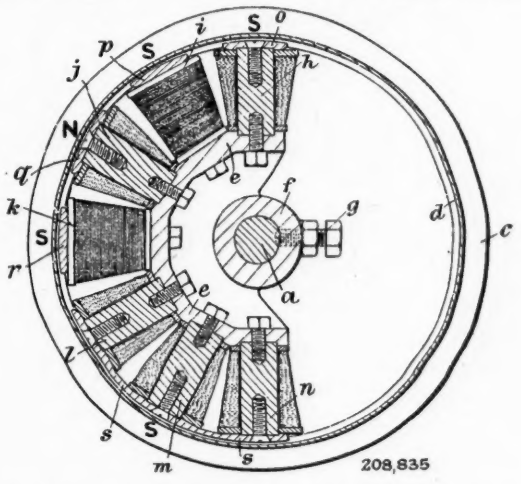
By Our Patents Correspondent

Aluminium

A process for obtaining plates or ingots from waste aluminium and its alloys which are free from the usual defects of remelted waste aluminium, has been patented by A. M. F. Leroux, of Paris. The metal is remelted with the addition of silicon, antimony or calcium, either together or separately. For pure aluminium, silicon is added in the proportion of 4 to 8 per cent., and for alloys of density 2·8 to 3, in the proportion of 3 to 6 per cent. The quantity of antimony is less than 1 per cent. and that of calcium less than 0·5 per cent. The additions may be made in the form of alloys. See International Convention Application No. 206,811, dated November 7, 1922.

Magnetic Separators

This magnetic separator is of the kind in which a drum of non-magnetic material is arranged to rotate around a number of fixed magnets arranged so that the magnetic field extends over a part only of the surface, so that magnetic material fed on to the drum is attracted to the surface within the magnetic field, and allowed to drop off when that part passes out of the field. The magnets in such separators have been alternately of different polarity, to cause a " jump " of magnetic particles as they pass from one field to the next, thus preventing the trapping of non-magnetic particles with the magnetic particles. This arrangement is advantageous when separating finely divided material, but if the material is in larger pieces, these



may fall during the change over or " jump." This disadvantage is avoided in a separator invented by H. H. Thompson and A. E. Davies, of Birmingham.

The drum comprises a non-magnetic rotary cylinder *d* mounted on a fixed spindle *a*, and the magnet structure is a semi-cylindrical casting *e* fixed to the spindle *a*. The radial magnet cores are arranged in the upper half in longitudinal lines, *h*, *i*, *j*, *k*, parallel to the axis, and in the lower half in circumferential series *l*, *m*, *n*. The pole pieces *o*, *p*, *q*, *r* in the upper half are longitudinal, while the pole pieces *s* in the lower half are circumferential. The pole pieces *o*, *p*, *q*, *r* may be of alternate polarity, and the pole pieces *s* of similar polarity. The particles are thus caused to " jump " during their passage over the upper magnets, but they are held unchangeably during their passage over the lower magnets until they are dropped at the bottom. The loss of magnetic particles is thus avoided. See Patent No. 208,835, dated October 11, 1922.

Process of Concentrating Ores

An improvement in the froth flotation process for concentrating ores has been patented by Luckenbach Processes, Inc., of San Francisco, U.S.A. This process consists in adding to the ore pulp a chlorbenzene, or a dichlorbenzene or a mixture of dichlorbenzenes, or a resin derivative such as pitch in solution in any of the chlorbenzenes, or a solution of a bituminous substance in chlorbenzene, or a solution of pitch and rubber in dichlorbenzene. This pulp is also mixed with a frothing and

collecting agent, aerated, and the froth separated. The preferred solvent is a commercial product obtained as a mother liquor resulting from the crystallisation of paradichlor-benzene, and containing varying amounts of ortho-, para-, and meta-dichlor-benzenes. The frothing and collecting agent is preferably the pyrogenous residue of soft or resinous wood or wood tar, known as pine tar pitch. Other suitable frothing agents are pine tar, animal, mineral and vegetable oils, and the pitches obtained by their distillation, resin, coal tar, phenol, etc. When pine tar pitch is used, the proportion is about 5 parts pitch to 7 parts dichlorbenzene, and about 2 lb. of this mixture is used per ton of ore.

If a small proportion of rubber is added to the pitch dichlorbenzene mixture, carbonates and oxides are floated as well as sulphides. Particulars of a number of different frothing agents are given, suitable for treating ores such as chalcopyrite, nickel ore, lead-zinc ore, and lead carbonate ore. The pulp may be aerated in either a neutral an alkaline or an acid circuit to form a froth. See Patent No. 207,977, dated November 13th, 1922.

Agglomerating Mixtures of Fine Ore and Fuel in Shaft Furnaces

C. GIESECKE, of Harsburg, Germany, has investigated the process of agglomerating blocks of fine iron ore by means of small coke within a shaft furnace, with a view to ascertaining the conditions in which the product shows a high degree of rigidity as well as porosity, compared with the usual sintered product. It is found that this result is obtained if the piece or block of ore which is not yet glazed in the sintering zone is afterwards brought into contact with very hot air, from which it takes up oxygen which transforms the ferrous or ferroso-ferric oxide into ferric oxide. To carry out the process, the top of the shaft furnace is charged with blocks containing uniformly distributed carbon. A shallow layer of 3 to 6 ft. below the top is rapidly heated by the injection of regulable amounts of flue gas introduced into the combustion zone to reduce the material to lower oxides or metal, but only slightly sintering the material. Air is continuously drawn up through the shaft to burn the gas and is heated by the finished blocks moving in the opposite direction. The oxidising zone below the combustion zone is 9 to 15 ft. in depth, and in it the blocks are oxidised and sintered, yielding the required porous and rigid product. See Patent No. 208,579, dated September 14, 1922.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

IRON AND STEEL.—Production of iron in the blast furnace. Part I. P. H. Royster, T. L. Joseph and S. P. Kinney. *Blast Furnace and Steel Plant*, January, 1924, pp. 35–37. Systematic investigation of furnace phenomena. In this article are discussed the reducing power of bosh gas and two theories of limited reduction.

Metalloids in basic pig iron in basic open-hearth practice. Part I. C. L. Kinney. *Blast Furnace and Steel Plant*, January, 1924, pp. 45–50 and p. 71. Emphasizes the effect on the cost of steel of the presence of varying percentages of silicon, manganese and phosphorus in the basic pig iron.

Review of iron and steel literature for 1923. E. H. McClelland. *Blast Furnace and Steel Plant*, January, 1924, pp. 13–17. Classified list of the more important books, serials and trade publications during the year.

SILVER.—The tarnishing and detarnishing of silver. Part I. G. W. Vinal and G. N. Schramm. *Metal Ind. (N. York)*, January, 1924, pp. 15–17. Causes of tarnishing and comparison of methods of removal; properties of moss silver.

ALLOYS.—The influence of cerium on aluminium. K. L. Meissner. *Metall v. Erz*, February (1), 1924, pp. 41–44 (in German). Aluminium-cerium alloys.

WELDING.—Some chemical aspects of welding. J. R. Booer. *Engineering*, February 15, 1924, pp. 221–223. Describes the chemical and physical phenomena in welding, the conditions encountered in welding practice, and the necessity for chemical control.

ELECTRO-PLATING.—Some relations between the microstructure of metal surfaces and electrodeposition made thereon. A. K. Graham. *Brass World*, January, 1924, pp. 3–7. Shows that reproduction does not depend so much on the preliminary chemical treatment as on the state of the metallic surface.

Diseases of nickel deposits. Part I. W. Voss. *Metal Ind. (N. York)*, February 1924, pp. 66–67. Tabulates symptoms, causes and cures.

Studies on electro-plating. Part II. The composition of plating solutions. W. E. Hughes. *Metal Ind. (Lond.)*, February 15, 1924, pp. 145–147 and p. 158, and February 22, 1924, pp. 169–170. Describes the characteristics of a good plating solution.

GENERAL.—Advances during and since the war in the metallurgical methods of production of the most important metals. K. L. Meissner. *Z. angew. Chem.*, January 3, 1924, pp. 1–4 (in German). Metallurgy in Germany of copper, zinc and lead.

The modern research laboratory for metallurgical products. Its organisation and utilisation. Part I. L. Guillet. *La Technique Moderne*, January 1, 1924, pp. 1–7 (in French).

Summary of the results obtained from experiments made during the years 1918 to 1923 on the effects of temperature on the properties of metals. A Mallock. *Proc. Roy. Soc.*, February 1924, pp. 129–134.

ANALYSIS.—Electrometric titration: an investigation of its methods and application to certain metallurgical analyses. G. A. Shires. *J. Chem. Met. Min. Soc. of S. Africa*, December, 1923, pp. 129–145. Discusses general principles and apparatus employed, and describes the estimation of iron, chromium, vanadium and manganese; a bibliographical appendix is added.

Estimation of gases and oxygen in iron, particularly cast iron. P. Oberhoffer, E. Piwowarsky, A. P. Schiessl and H. Stein. *Stahl v. Ersen*, January 31, 1924, pp. 113–116 (in German).

Determination of silicon in iron-silicon alloys by their physical properties. T. D. Yensen. *Engineering*, February 8, 1924, p. 173. Physical properties in question are the electrical resistance and the hardness.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

ASHBY AND ANDERSON, LTD., Leeds, founders. Registered January 11th, £800 debentures, to Branch Nominees, Ltd., 15, Bishopsgate, E.C.; general charge.

BODITHIEL SILVER LEAD MINE, LTD., London, E.C. Registered January 22nd, £3,000 debentures balance of £5,000; general charge. *——. December 31st, 1922.

CORNTHWAITES, LTD., Sheffield, steel manufacturers. Registered January 28th, £1,200 2nd debenture, to D. Cornthwaite, 12, Hartington Road, Millhouses, Sheffield; general charge, ranking next after charge dated July 5th, 1920. *£3,000. May 9th, 1923.

HOLLOWAY (GEORGE T.) AND CO., LTD., London, E., metallurgists. Registered January 23rd, £100 and £250 debentures part of £5,000; general charge. *£2,900. January 12th, 1923.

LITHAUER, LTD., London, W.C., metal merchants. Registered January 18th, £1,500 debentures, to I. J. Lithauer, 23, Aubrey House, Maida Hill West, W., metal merchant; general charge.

Satisfaction

DIMMERS, LTD., London, W.C., ironfounders. Satisfaction registered January 25th, £250; registered December 31st, 1923.

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor, THE CHEMICAL AGE, *8, Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

Metallurgists and Chemists

FROM remarks from time to time dropped by those holding administrative and managerial posts in connection with metallurgical works, it is not difficult to gather that the analytical and works chemist in this particular branch of industry has at last come to be recognised as something more than an auxiliary unit whose advice is tolerated but seldom endorsed or acted upon. In this respect the metallurgical industry merely provides a modern parallel with almost any other industry of importance, and though the general introduction of scientific methods founded on chemical and physical principles may be a compliment to the present-day chemist his recognition is also a compliment to those who have the foresight to appreciate that his utilisation is a direct asset to undertakings which primarily exist for the purpose of making profits. Only recently we were studying the opinions expressed by the general manager of a well-known iron and steel works in this country, and were struck by his statement that any progressive blast-furnace plant should be equipped with its own laboratory and chemists on the site, and the duty of the chemical staff should be to keep the manager immediately informed of any change in the analysis of any of the materials used in the furnace. Of all exact metallurgical processes the reduction of iron in the blast furnace is probably the one which has been controlled in the crudest manner. Yet the reactions involved are undoubtedly complicated, and unless satisfied with chemical accuracy regular working of the furnace cannot be expected. To-day supplies of ore may be drawn from a multitude of different sources, and it is impossible for the most experienced of overseers to burden his furnace with sufficient accuracy merely by visual inspection. And was it not Mr. Fred Clements who once said that many of the practical dislocations which occur are directly attributable to incorrect burdening? So that the blast-furnace manager (realising this possibility) carries more fuel than he knows his furnace requires, the excess being a burnt-offering to show his respect to the Unknown. Few will disagree with the rebuke, but it is the chemist who holds the key to the unknown and who can cut down the outlay on the burnt-offerings.

A Law of Inverse Squares

PROFESSOR TURNER, in his presidential address to the Institute of Metals, at the annual meeting on March 12, made a very valuable and important contribution to science by the enunciation of a new law, the existence of which, although long suspected, has not until now been definitely formulated. It is that, in many cases, the permanent value of a communication varies inversely as the square of its length. The practical application of this law supplies a direct and simple mode of dealing with a condition of acute "tangle" which bids fair to paralyse the activities of some of our technological institutions by the simple process of depleting their funds.

As a broad generalisation it may frankly be said that most papers read before most institutions are too long. There are also too many of them, and the general standard is not as high as it used to be years ago. The cost of printing and paper, and of reproducing illustrations, many of which have to be redrawn, at additional expense, because unsuitable in the first instance, is exceedingly heavy. Many of the papers are of ephemeral value, and some are of no value at all. It may be of interest to attempt a rough classification of the categories into which they fall. The best and most important are those by the acknowledged masters of their subject, the big men who know what they are writing about and have the experience which teaches them what is germane, and what may be omitted. Such papers, announcing new discoveries, or throwing fresh light on obscure problems, rarely err in being too long. In the second category may be placed papers by new or comparatively new men, who may have new matter of importance to describe. Such papers often require expert pruning. The third category is perhaps the most troublesome. This consists of—often admittedly—students' work; an account of some not very important research carried out for a thesis. Some of this work is put forward directly in the student's own name; some of it is "fathered," more or less by the professor in whose laboratory the work has been done. Such papers often begin with the prescribed rehearsal of what has been done before by earlier investigators, after which certain experiments are described, their results are recorded in tables, as well as plotted in graphs—an often quite unnecessary reduplication—and finally the paper winds up with a number of photomicrographs, of which long and detailed descriptions appear in the text. This again is, as often as not, a perfectly needless reduplication; it is not invariably necessary to accompany a description of a structure with pictures of constituents which everyone knows and can take for granted. Not all such papers are, by any means, valueless; they are, on the other hand, seldom of sufficient value or merit to justify their publication by the central or leading institutions dealing with their subject matter. Their proper place is the local association. It is something of an impertinence to assemble the experts of a great industry to listen to the elementary "thesis-work" of their juniors.

The Izod Impact Test

AN example of the Student paper which affords an exception to Turner's Law, is the paper by Mr. Bunting, read at the Institute of Metals meeting on the brittle ranges in brass as shown by the Izod impact test. The research falls into the category of those which are of direct practical application and throw new light on known facts. The discussion which ensued on the reading of this paper showed effectively the interest it aroused.

A possible remedy for the state of affairs which admittedly exists in the plethora of papers of mediocre interest put forward for reading before institutions of established technical importance might lie in publishing them in comparatively brief abstract, and filing the original manuscript for reference. When an investigator arrives, rightly or wrongly, at a conclusion which is in conflict with accepted views, it is manifestly unfair to him to suppress the often voluminous details of experiments, the tabulated results, and diagrams by which alone the soundness or unsoundness of his conclusions has to be determined. A summarised statement of the results would, however, often suffice to enable critics to form some judgment as to the nature of the evidence relied on. Much time and much expense might be saved by the adoption of some such method.

Corrosion and Scaling in Modern Boiler Practice

Notes on Causes and Prevention

The subject of boiler corrosion and scaling is one in which many engineers and metallurgists have been vitally interested for a number of years, and, speaking generally, the present position is far from satisfactory. Compared with many other sides of metallurgical practice, a comparatively small amount of work has been done on this subject by the manufacturer himself, with the result that he either does nothing at all to his boilers or else uses one of the many "cure-alls" which are on the market, and which, incidentally, are sold at fabulous prices. To illustrate this from the writer's experience: a certain firm were paying as much for a preparation as it would cost them to re-tube their marine boilers every year. Incidentally, these particular boilers should require to be re-tubed about every ten years under normal working conditions, and, apart from the cost, very doubtful results were being obtained from the use of the preparation.

Feed Water

The question of suitable feed water to boilers is one of vast importance, and every individual case should be investigated and judged on its merits because of the many and varied types of water and boiler conditions.

The three troubles in boiler practice are salts in solution in the feed water, dissolved gases in the feed water, and occluded oil. All waters contain salts in solution—some harmless and some distinctly harmful—and their removal or conversion to an innocuous state should be performed in some fashion or other before the water is fed into the boilers. Undoubtedly, the ideal plan, wherever possible, is to condense the steam; but this is only possible in such a case as a power system when the steam can be led direct from the turbines to the condenser. Under these conditions as much as 90-95 per cent. of condensate may be recovered and fed back to the boilers, and if the "make-up," which is lost through feed pumps or other auxiliaries is derived from a suitable type of evaporator, then the boiler plant can be fed entirely by distilled water.

Hardness of Water

Hardness of water is divided into two classes—viz., temporary and permanent. The former, consisting of the bicarbonates of calcium and magnesium can be mainly removed on boiling; the bicarbonate of lime is completely removed by precipitation as calcium carbonate, whilst the magnesium bicarbonate is only partially removed, due to the somewhat higher solubility of magnesium carbonate. So that if the feed water is preheated by, say, waste steam jets, considerable removal of temporary hardness takes place by precipitation in the feed tank. Softening plants remove temporary hardness by the extraction of carbon dioxide from the bicarbonates and consequent precipitation as the normal carbonates; in this case also the higher solubility of magnesium carbonate has to be remembered.

Permanent hardness is the term given to the chlorides, nitrates and sulphates of lime and magnesia; these salts are not precipitated on boiling, so that some chemical treatment is necessary to effect their removal or conversion to innocuity. If fed to the boilers they may be the cause of a whole host of troubles. On concentration of the water they will separate out and form a hard, crystalline scale on the plates and tubes of the boiler, and every thickness of an eighth of an inch of scale on the heating surface means an increase of approximately 25 per cent. in the fuel consumption. The loss due to scale alone in Great Britain is estimated at five million tons of coal per year.

In addition to scale-forming tendencies there is the more important difficulty—corrosion. Magnesium chloride has a great tendency to hydrolyse at the temperature and pressure of the boiler with the production of free hydrochloric acid, thus—

$$MgCl_2+2H_2O=Mg(OH)_2+2HCl.$$

The magnesium hydroxide is deposited as sludge, whilst the free hydrochloric acid attacks the boiler plates, forming iron chloride according to the following reaction—

$$2HCl+Fe=FeCl_2+H_2,$$

and the iron chloride is acted upon by water with the formation of black oxide of iron and liberating free hydrochloric acid again, thus:— $FeCl_2+H_2O=FeO+2HCl$,

and as a result of this reaction the corrosion proceeds further, and once corrosion is set up the cycle of reactions causes it to flourish. In the presence of free oxygen red rust is produced instead of the black oxide of iron.

This set of conditions is likely to exist where no magnesium chloride is present, but where the water contains magnesium sulphate along with sodium chloride. Interaction is likely to take place between these two salts with an interchange of radicles, thus:—

$$MgSO_4+2NaCl=Na_2SO_4+MgCl_2,$$

and there is consequently a likelihood of subsequent hydrolysis of the magnesium chloride produced. This hydrolysis is practically negatived in the presence of free alkali, and the one most commonly used is sodium carbonate.

Softening

Softening, or the removal of the hardness of waters, is mostly carried out by means of either sodium carbonate alone or sodium carbonate along with lime.

Soda is capable of removing calcium salts, but not magnesium salts, and hence the necessity for the use of lime. The softening, which can be performed either inside or outside the boiler, is brought about by the following typical reactions:—

Temporary Hardness $CaHCO_3+Na_2CO_3=CaCO_3+NaHCO_3$
pptd.

Permanent Hardness $CaSO_4+Na_2CO_3=CaCO_3+Na_2SO_4$.
pptd.

$MgSO_4+Na_2CO_3=MgCO_3+Na_2SO_4$.

$MgCO_3+Ca(OH)_2=CaCO_3+Mg(OH)_2$,
pptd.

However, there are no two opinions as to where the softening should be performed, namely, outside the boiler, for if performed inside the likelihood of priming and similar trouble has to be met with. Very elaborate softeners are at present on the market and the mechanical side of them—apportioning gear, etc.—is almost perfect; but from the chemical side they are apt to be neglected—if the firms who made the softeners supplied a chemist with each one, then all would be well—for usually a works chemist is too busy with other matters to test the softener and water every day and thereby keep up its efficiency, with the result that the softener falls into disrepute and ceases to function efficiently.

As opposed to this method of treatment there is the colloid process, whereby some material of a colloidal nature is added to the boiler; the function of some protective colloids is very remarkable, and in a boiler they tend to keep the salts in a jelly-like form or "sol" condition instead of allowing them to deposit in the form of crystalline scale. This process has much in its favour—it is very easy to manipulate; but the writer is of the opinion that it is of little value in its entirety, but is most useful when coupled up with some kind of softening process.

Dissolved Gases

The question of dissolved gases is one of utmost importance, for most waters, whether town's supply, river or spring, contain something like 6 to 8 c.c.s per litre of dissolved oxygen along with varying amounts of dissolved carbon dioxide. Various processes are available for the very necessary process of degasification, the commonest method in use being that of adding some tannin product to the feed water, for this has the effect of dissolving the oxygen present. This process, however, does not affect the carbon dioxide, which is commonly supposed to be innocuous in the absence of oxygen. The most usual process for the removal of both is that whereby the gases are actually extracted through an ejector by means of temperature and vacuum. This latter process has an obvious disadvantage in that a separate plant is required, and the best results are obtained from it on a power system where the only treatment necessary is that of degassing. The

interposition of a degassing plant between the condenser hot-well and boilers renders the whole system wellnigh perfect, and wonderful results are being obtained by this means on various power stations in different parts of the country.

Oil

The presence of oil, where feed pump cylinder drains have been led into the feed tank, or oil creeping along a turbine shaft to the low pressure gland and so being drawn into the condenser, is a great source of trouble in boilers, due to its protective action on the plates and consequent overheating One example in the writer's experience is of a boiler plate sinking three-quarters of an inch, due to accumulated fat on the furnace crown of a Lancashire boiler.

The commonest process for oil removal is the alumino-ferric and soda process, which is simply an application of colloids.

However, the writer is of the opinion that oil can be successfully kept out of the feed water by keeping all glands in good condition and running the drainings from the pump cylinders away from the feed tank—on no account should the drainings have access to the feed tank. This is simply an application of the old adage "Prevention is better than cure," and by this means all oil troubles can be safely eliminated.

Conclusion

In conclusion, the most widely applicable process for, at any rate, all ordinary feed waters, is one in which the foregoing principles are all linked together. A solution of the following composition :—

	Per cent.
Water	84
Sodium Carbonate	6
Tribasic Sodium Phosphate	3
Sodium Tannate	4
Dextrin	3

is an admirable one for most purposes. For, to give an example, if added to the feed tank at the rate of about 1 gallon of solution to 10,000 gallons of water it will give a P_H value of about 9 to 12 to a water of the following analysis :—

SiO_2	0·30 pts. per 100,000
Fe_2O_3	0·20 ,, ,,
$CaCO$	1·0 ,, ,,
$CaSO_3$	1·4 ,, ,,
$MgSO_4$	0·8 ,, ,,
$MgCl_2$	1·5 ,, ,,
$NaCl$	1·45 ,, ,,
Oxygen	6 c.c.s per litre.
Carbon Dioxide	3 c.c.s ,,

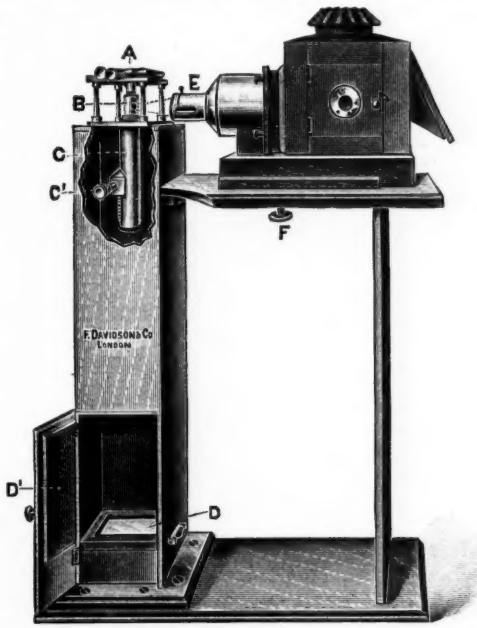
A P_H value of 10 is equivalent to an alkalinity of about 6 pts. per 100,000 of free sodium carbonate and is about ideal for ordinary boiler working. In addition, the sodium carbonate and phosphate have the effect of softening the water, and the phosphate increases the surface tension and thereby is a militant against any possibility of priming. The tannin product dissolves free oxygen, and the dextrin has the effect of colloidalising the scale-forming salts which have not been precipitated by the softening reagents. So that the net result is that no active corrosion can take place in the boiler, and also that little or no hard scale can possibly be formed ; the latter simply becomes a sort of sludge, and much of it can be removed by blowing down at regular intervals ; and when no corrosion is taking place in a boiler and the scaling tool is replaced by the wire brush and hose-pipe, then the boiler engineer can consider that his troubles are as far reduced to a minimum as it is humanly possible to reduce them.

Temperatures in Charcoal Furnace Practice

In a study of temperatures encountered in charcoal iron-furnace practice, being conducted by the Department of the Interior at the Minneapolis Experiment Station of the United States Bureau of Mines, samples of charcoal and slag have been obtained from four charcoal iron furnaces for determining the amount of sulphur in the fuel and that carried off in the slag. The results of these analyses will be incorporated into a report comparing the sulphur which is present in the materials used in charcoal and coke furnaces and the temperatures which are attained. Due to the relatively small amount of sulphur in charcoal, little attention is given to the quantity of this element in the raw materials.

Rapid Metallographic Photography

It is a tiresome business, as a rule, to prepare a photomicrograph of a metallurgical specimen. A slice has to be taken of the metal and mounted, the microscope and camera lenses adjusted, the exposure calculated, etc., so that in some cases it is hardly worth the trouble involved to obtain a photograph. We recently had an opportunity, however, of examining a beautiful piece of apparatus designed by Dr. F. Rogers which standardises the whole of the steps, and enables photographs of metallic specimens to be taken in an incredibly short space of time compared with the usual methods. This result is obtained partly by avoiding altogether the preparation of a microscope slide as generally understood, and partly by an adaptation of the "Davon" super-microscope, which has already been described in these columns. An instrument on this principle is mounted vertically, and the specimen to be examined is placed on the top, at A. The specimen can be any small piece of the metal with a flat polished face, so that its preparation is only the work of a minute or two. Illumination is obtained from an ordinary lantern with condenser



through a cover-glass reflector (B) to the specimen, which is projected through the super-microscope system on to the photographic plate at D. By means of a light-tight door the projected image is clearly seen and may be focussed, but it should be clearly understood that there is no need for re-focussing for different specimens, since they replace one another in the same plane. The makers, F. Davidson and Co., 29, Great Portland Street, London, W.1, supply the instrument, which is known as the "Metalworks" outfit, to produce fixed magnifications of 100, 250, or 500 diameters. As the price is extremely moderate, being only £37 10s. without the lantern, it should prove a most valuable instrument in all metallurgical works, but particularly in the smaller ones, where it is not possible to have anyone fully employed on metallographic examinations.

A Big Vickers Contract

The municipality of Copenhagen has just placed a very large contract for complete boiler house equipment for the municipal electric power supply station with Vickers Spearing Boiler Co., Ltd., London, an affiliated company of Messrs. Vickers, Ltd. The contract includes boilers of 2,000 h.p. each, with economisers, stokers, air heaters, superheaters, mechanical stokers and all accessories. The whole of this plant will be manufactured in Great Britain. The contract was obtained in open international competition, and was awarded on the merits of the proposal.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

"Academic" Studies Materialising

THE work of Laue, Friedrich and Knipping, Bohr and Planck on crystal and atomic structure, so admirably developed and supplemented by our fellow-countrymen, Beilby, Rutherford and the Braggs, is having a direct and immediate repercussion on the theories and concepts of modern metallurgy. This repercussion must profoundly affect and modify practice, so we have here an example of the influence of purely scientific and mathematical research work, in other words, too often hastily dismissed as "academic" upon current technology. At the meeting of the Institute of Metals, two papers devoted to these aspects of metallurgy were read: one by a brilliant trio of young Swedish scientists, Jette, Phragmen and Westgren, and the other by Professor F. C. Thompson and W. E. W. Millington, of Manchester University. As in point of chronological sequence, x-ray work on metals affords the basis of structural investigation and its theoretical interpretation, it may be well to deal with Dr. Westgren's paper first, the more so as it shows in a very interesting manner how the earlier work on iron structure, presented before the Iron and Steel Institute at the May meeting in 1922, has been carried a step further and the same methods employed to elucidate the constitution of copper-aluminium alloys.

X-Ray Work on Binary Alloys

WHAT chiefly emerges from Dr. Westgren's paper is the confirmation given by x-ray examination of a series of copper-aluminium alloys, of the equilibrium diagram plotted some 17 years ago by Edwards and Carpenter, subject to some slight rectifications in regard to the 12 per cent. aluminium alloy, discrepancies in which had already been noted by other observers. This confirmation affords evidence not of the stability and truth of the phase rule, which have scarcely ever been in doubt, but of the intrinsic accuracy and value of the x-ray examination methods, and therefore of the positive truth of much of the recent physico-mathematical theory as to atomic and molecular structure upon which such methods are based. The newer theories have not been long enough established for them to have been firmly assimilated by metallurgists in general, so that papers of this kind which emphasise the concordance and harmony of their results with those obtained by older and more familiar methods will help greatly in their general dissemination and acceptance. The paper is accompanied by Debye photograms and Laue spectrograms, which with the mathematical reasoning adduced lend authority to the conclusions. Difficulties in manipulation have prevented the development of experimental work on the β phase, but the α, δ and γ phases are satisfactorily brought into evidence and their nature illustrated.

Lattice Structure and Strain

IT is to be regretted that Sir William Bragg was unable to be present at the meeting, but he was ably represented by Dr. H. Weiss, who took part in what proved to be an exceedingly interesting discussion. The powder method was, he pointed out, one which might before long be found useful in giving qualitative results as to the presence or otherwise of constituents too small to be detected by the microscope, but, for accurate work in research, crystals were alone advisable. Dr. Rosenhain thought the x-ray spectrum, in the case of such alloys, would probably be that of the predominant phase, and doubted whether the method adopted by the authors of merely allowing the alloys to cool slowly from fusion was satisfactory as the resulting solid solutions would probably not be homogeneous. After all, the subject may be said to be still in its infancy, and a great many points will require to be cleared up before metallurgists can accept the results of x-ray examination as conclusive. It has already been pointed out by a number of observers, as was stated at the Jubilee of the Physical Society last month, that the wave length of scattered rays differs from that of the incident rays, a function not as yet allowed for in the mathematical computation of photograms of diffracted rays. Also, it would seem natural to conceive that lattice distortion due to strain may considerably modify the results, and as yet little or no work has been done from this point of view. The author's method of slow cooling would at least have the advantage of "normalising" the structure of their alloys, and so affording, as far as possible, spectrograms of lattices free from the distorting influences of internal strain.

Atomic Movement in Stressed Metals

THE "atmosphere" of the paper by Mr. Millington and Professor F. C. Thompson is totally different to that of the paper just discussed. We are no longer embarked on the smooth deep waters of experiment and observation backed by mathematical evidence, but on a troubled pool of speculation. The paper is, nevertheless, to be warmly welcomed as showing that the authors possess that valuable gift, scientific imagination, although the time is not ripe for such speculations to be taken seriously. It suffers from a tendency evinced in an avalanche of recent pseudo-popular text books, to seek to explain in simple language phenomena which cannot be so explained, and to strain analogies in the process. That stresses may be transmitted in a way which can be demonstrated by the movement of layers of ping-pong balls over and under one another is not necessarily untrue; there is some evidence that atomic systems are spherical, or elliptoid. To speculate on the mechanism of the glide is to form concepts which may be both helpful and interesting, yet it may be doubted whether the results of such speculations can be properly applied to the concrete and specific explanation of definite occurrences of fatigue failure in the brass tubes of a particular feed water heater. The direct issue involved is matter of fact, and the conclusion that failure, in the particular instances adduced, is due to the formation of bars identical with Neumann bands —or bars as the authors prefer to call them—is legitimate matter for discussion, the more so as the mechanism of their formation is understandable under ordinary and accepted modes of reasoning. The analogy of the incidental subject matter of the paper was felt by many of the speakers to be strained and unnecessary. Apart from all other considerations, it introduces fresh difficulties of its own, which Dr. Rosenhain pointed out in his lucid criticism of the paper. Miss Elam, whose status in metallurgy is recognised and who, like Dr. Rosenhain, has the gift of lucid expression, thought likewise. All this notwithstanding, the paper promised by the authors for the forthcoming meeting of the Iron and Steel Institute will be looked forward to with interest and pleasure, for its conception is brilliant, and, provided the authors are prepared to support it with a proper amount of actual experiment, it may well serve to stimulate enquiry into the actual mechanism of the movement of particles of stressed material. It is possible that results of value might emerge from experiments in which for example, bicycle balls, magnetised to supply the elements of cohesional forces, were subjected to the methods adopted by Professor Thompson and Mr. Millington.

Statistics of the Iron and Steel Industries

VIEWED as a whole, the "Statistics of the Iron and Steel Industries" just published by the National Federation of Iron and Steel Manufacturers (Caxton House, Westminster; price 5s. 4d., *post free*) are exceedingly well compiled and distinctly useful. Incidentally, however, it might be questioned whether it is worth while delaying so long the publication of the figures relating to British production merely because those relating to certain foreign countries have not been available earlier. The figures relating to the French production of steel ingots are grouped under the headings "Thomas" "Bessemer" and "Martin"; and those for the Belgian output under the headings "Thomas Converter," and "Open-hearth." These headings correspond with the returns made in the respective countries of origin, but it might be as well, as far as possible, to provide more systematised headings for English readers who may not always know that "Martin Steel" corresponds with open-hearth steel (whether acid or basic), whereas "Thomas" steel and "Bessemer" correspond respectively with basic bessemer and acid bessemer steel respectively. The compilation of trade statistics is in any case a thankless task. The least that can be said of those in question is that the Federation and its statistical officer, Mr. Birkett, are to be congratulated on the way they have discharged their task.

A New Sponge Iron Process

A NEW process for the production of sponge iron has been developed by the U.S.A. Department of the Interior, in co-operation with the University of Washington, as the result of experimental work conducted during the past three years at the Northwest experiment station of the Bureau of Mines, Seattle, Washington. Sponge iron, because of its porous structure and consequent exposure of an extremely large surface of metallic iron, is especially adaptable to the precipitation of copper, lead, and other metals from their solution. The development of a process by which sponge iron may be made cheaply from iron ore and low-grade coal and afterwards converted into iron and steel products by treatment in the electric furnace would be of especial economic importance to the Pacific Coast region of the United States, a territory remote from the larger iron and steel producing centres, but endowed with cheap electric energy to take the place of the expensive coke that would otherwise have to be utilised in iron and steel production.

On account of the removal of oxygen from iron oxide ore, the structure of sponge iron is very porous, an extremely large surface of metallic iron being exposed. As a result, sponge iron is an active reducing agent and precipitates metals from solution with greater speed than do the more massive forms of iron, such as steel scrap and iron turnings. The Bureau of Mines considers that sponge iron will probably be used extensively for the precipitation of copper, lead, and other metals from hydrometallurgic solutions. The many advantages afforded by the use of sponge iron for this purpose should cause an expansion of processes involving leaching and precipitation. Its value as a reducing agent should cause sponge iron to replace other forms of metallic iron now used as a reagent in certain chemical production processes. New processes utilizing cheap sponge iron may be developed to take advantage of the great reactivity of metallic iron in this form. These processes could reconvert to sponge iron any iron oxide obtained from the reaction.

Conversion to Steel

THE possibility of making sponge iron and converting it to steel without passing through the stage of pig iron production has been suggested from time to time, and hundreds of so-called "direct steel" processes have been proposed or tried during the past century. Unquestionably, the production of steel from sponge iron has theoretical advantages over present standard methods. Moreover, the production of both steel and pig iron from sponge iron has economic advantages in certain localities. In regions remote from iron and steel producing centres, where coke is expensive and electric energy cheap, sponge iron made cheaply from iron ore and low-grade coal can probably be converted into iron and steel products by treatment in the electric furnace in competition with imported goods. The fact that both the electric melting and sponge iron production processes can be conducted economically on a small scale makes such a proposed process particularly advantageous in communities that do not consume much iron or steel. Electric furnace processes, being inherently expensive, are advocated for the production of iron and steel only where unusual conditions prevail.

There is some hope in the opinion of the Bureau that sponge iron can be briquetted and melted in the open-hearth steel furnace without too much oxidation. If this could be accomplished a much larger field of usefulness would be opened up for cheap sponge iron. In the process developed by the Bureau of Mines and University of Washington investigators, almost any type of iron ore is satisfactory for the production of sponge iron. Experiments conducted at the Seattle station showed that similar results are obtained with magnetite, hard and soft hematite, limonite and sintered hematite. It is probable that sponge iron will be made from such by-product materials as flue dust, pyrite cinder, various slags of high iron content, and iron oxide sludge. The Bureau of Mines process consists in passing a mixture of iron ore and coal through a rotating kiln heated at one end to a temperature sufficient to convert iron oxide to metallic iron, discharging, cooling, and separating the sponge iron from the residual coke and siliceous material on a magnetic separator. Details of these experiments are given in Serial 2578, by Clyde E. Williams, Edward P. Barrett, and Bernard M. Larsen, which may be obtained from the Department of the Interior, Bureau of Mines, Washington, D.C., U.S.A.

Malleable Iron Tests

IN the specification of malleable iron castings, recently issued by the British Engineering Standards Association, greater importance is attached to mechanical than to chemical tests. This will satisfy metallurgists especially, as the ultimate tensile strength required is comparatively low. It must not be less than 20 tons per square inch, while the minimum elongation in 2 in. must not be less than 7½. It is quite usual, as a matter of fact, to obtain an ultimate strength of over 23 tons, although the Admiralty test is only 18 tons per square inch of area in tensile strength, with a maximum elongation of 4½ per cent. in a length of 3 in. The bend test of the British Admiralty is also different from that proposed by the Engineering Standards Association. The Admiralty recognise that a bar shall withstand bending at an angle of 90 degrees round a radius of 1 inch without sign of fracture, while the Association test bar of the same dimensions—1 in. by ⅜ in.—is bent round a ¾ in. radius.

There are fewer than 250 malleable iron foundries in the United Kingdom, and the question of mechanical tests is the same practically for the whole ferrous foundry trade and it concerns the entire engineering industry. French metallurgists and foundrymen favour the Fremont-Portevin method, which consists of boring bars from a thick section of the casting. The difficulty of obtaining a bar that is representative of the casting is due to the unequal cooling of different sections, and the ultimate object of a test bar is to let engineers know the strength of the actual casting used. The International Test Bar Committee, which was formed at Paris last September, is conducting experimental work on round test bars, other shaped test bars being discounted because of the variation due to casting and cooling conditions of such bars. The diameters to be considered are to be 1·2, 1·3, 1·4 and 1·5 in. They are to be cast on end, one in a mould 21 in. long, and tested between 18 in. centres. The moulds are to be either dry sand or cores and the test bars are not to be tumbled or machined. Twelve bars are to be cast from a heat, six to be tested by the maker, and six to be sent to the Committee.

Growth of Canadian Mineral Production

PROGRESS has been very marked in the mineral production of Canada during 1923, and several new commodity production records were established, while the output as a whole advanced 16·1 per cent. in value over the corresponding figures for last year, and only about 7 per cent. below the record value of $228,000,000 attained in 1920. New output records were established for coal, lead, zinc, asbestos and the value of cobalt. Copper production, while considerably below the record war-time outputs, was more than double the tonnage produced in 1922, and amounted in all to 87·94 million pounds. Nickel reached a total of 62·45 million pounds as against 17·59 million pounds last year, and while gold and silver were both less than in 1922, the outputs were greater than in many other recent years and together accounted for values amounting to 36·80 million dollars. The principal mineral-producing province of Canada in 1923 was Ontario, British Columbia came second, while Alberta was third.

Threatened French Metallurgical Strike

IT is stated that the French Congress of Factories organised by the extremist syndicates in the metallurgical industry and the aeroplane-building industry has adopted, in spite of the opposition of a large minority, a decision to call a general strike in the iron and steel trade on a question of wages. A special commission has been appointed to make all arrangements necessary to carry out the decision at a convenient date.

Ironworkers' Wages Advance

WAGES regulated by the sliding scale under the Midland Iron and Steel Board will be advanced from Monday, April 7, by five per cent. as the result of the rise in the selling price during the first two months of the year. Ironworkers will thus be receiving higher pay than they have had since the early summer of 1922. The plussage on base rates becomes 60 per cent. Employers complain they have had no equivalent, inasmuch as production costs advanced more markedly than selling prices.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE tone of the iron and steel market during the month of March can hardly be described as cheerful. Rather it has reminded us of the dispiriting months of last year; and already trade papers are beginning to talk of the depression which has set in, and which may last until the autumn!

It is, to say the least, disheartening to see the industry slipping back again, through causes for which the steel makers are not responsible. The new year opened optimistically, and there seemed to be the right atmosphere to encourage steady progress. The one thing necessary to make that progress was industrial peace, and it is just the lack of that one thing that is taking the life out of the industry again. First we had the railway strike, then the dockers' strike, and now the threat of a coal strike, each in turn and the last most of all undermining that confidence on which a healthy state of trade must depend. The consumer, at a loss to know which way things are going, prefers to keep back his orders other than for his bare day-to-day requirements. Manufacturers, anxious to find work to keep the mills going, compete keenly for what work there may be, prices weaken, and there is set up a condition conducive only to further weakness.

One wonders how long it will go on and what the end will be. The steel manufacturers have not yet lost sight of the practical difficulties which were the result of the last coal strike. Not only was there the general loss consequent on the closing down of works, but the damage done to steel furnaces by that enforced stoppage must be reckoned in the hundreds of thousands of pounds in the aggregate. It is to be feared that a repetition of the trouble would be fatal to some of the works, who are already finding it a struggle to carry on. Hope of a settlement with the miners has not yet been abandoned, and unless extreme counsels are allowed to overrule the disaster may yet be averted.

The Wages Problem

There is also a movement afoot for exacting increased wages for the lower-paid men in the steel works. That question will receive serious and sympathetic consideration by the employers. It is certain that the industry cannot stand any increase in its wages cost at present, yet it must be admitted that certain classes of men in the works are receiving wages which are insufficient to maintain a home. A solution of the problem may be found along the lines of a more equitable distribution of the total wages, so as to bring the two extremes nearer together; also by a reconsideration of the hours of working. In dealing with these matters there needs to be an appreciation of the difficulties with which the steel maker is confronted. There is scarcely a steel works in the country which is not losing money on the manufacture of steel. Such a condition cannot be prolonged indefinitely, and the end will come quickly if organised labour pursues a policy which will materially increase these difficulties.

Not only the labour troubles, but the disorganised state of the Continental market has added to the uncertainty here. The rapid depreciation of the franc caused some anxiety, but the suddenness of it prevented much actual business. The equally sudden appreciation has had a similar effect. Moreover, the Continental works are booked well ahead, and cannot offer deliveries early enough to meet the English requirements. On the other hand, the demand for English iron and steel on the Continent is much below the normal. The works on the North-East Coast and in Scotland have felt the effects of this more particularly.

The reduction of the Reparations Duty from 26 to 5 per cent. has made the way easier for German competition. We are approaching the time when this competition will be keen and constant as of old. The majority of the Ruhr works are making good recovery and are getting near to normal working. The control of the vast resources for the manufacture of iron and steel, which is in the hands of the French and German owners, is a grave menace which has not been lost sight of by the English makers, and in this connection it is interesting to note that there has been an unofficial visit of representatives of the French, Belgian and Luxembourg steel makers to this country to talk over the position.

Pig Iron Market

The pig iron market has not been good. Cleveland prices were reduced at the beginning of the month owing to the foreign competition, and the Northampton and North Staffordshire brands followed suit. The Lincolnshire and Derbyshire irons remained comparatively firm. During the past week there has been a rather better demand. Cleveland prices were advanced 1s. on March 28th. Makers know, and consumers are apparently realising the fact, that pig iron prices cannot go any lower without forcing the alternative of closing down the plants. Stocks in consumers' works are practically used up, and there is a disposition to make forward contracts for the next quarter while prices are favourable. There is also a little better demand from the Continent, due no doubt to the rise in the French exchange. Fortunately the coke makers too have appreciated the position of the pig iron trade, as they have decided to retain the official price of coke at 24s. at the ovens until May 17, when another meeting will be held to decide the price for a further period.

Whatever settlement is arrived at between the miners and the employers, it is certain that the wages will be increased, which means an advance in the price of coal, and we shall again be in the anomalous position of paying more for coal than for coke. This is in fact already the case. The fear of a strike has occasioned such a rush for supplies that it is almost impossible for works to obtain their regular deliveries, and absurd prices are being asked for odd lots that are available. The poor steel maker is once more left in the lurch. He is faced with reduced prices for his manufactures, while the cost of production is increasing.

Prices of Plates

During the month the associated plate makers have met to discuss the price of plates, and have decided that no official alteration shall be made at present. The ruling price is £10 5s. basis and orders are readily taken at that figure, or even less. There is not much demand for heavy plates. Thinner plates and sheets are stronger, and it is possible to obtain more than the usual list extras for these. There are some good orders for them for the motor trade in the Midlands, but one or two of the Scotch works are competing very keenly for them, and are taking them at prices which, after deducting the heavy carriage, must entail considerable loss. The Scotch works generally are very short of orders, and there is a lot of plant there standing idle.

The Small Bar Association has not survived long. Nominally the Association still exists, but for all practical purposes it is at present dissolved, as members are free to quote what prices they like. This turn of events is not altogether surprising. In good times there is no difficulty in maintaining prices, but when trade is bad it is the usual experience that undercutting is resorted to, in roundabout ways, and unless an improvement in trade sets in there is the inevitable result as we now see it. Naturally prices have fallen, and to-day's quotation is about £10 per ton or even less. There is, however, a wide variation in quotations for the moment, as the market is rather unsettled.

These reductions may be necessitated by the competition from the re-rollers, who are using either cheap seconds quality billets from the English works, or even cheaper foreign billets, by which means they are enabled to underquote the English bar makers. It is useless, however, to try to make English bar prices compete with the Continental prices: the difference is too great to be bridged. It is no use trying to capture this trade from the consumers, who are willing to use the cheap foreign steel. There is a considerable trade in steel bars for which foreign steel will not be accepted, and we still think it is bad policy to spoil this trade by unreasonable price cutting. It is significant that the London, Midland and Scottish Railway are putting a note on all their steel orders to the effect that only English steel must be used.

Stainless Steel

There has recently been some amount of interest in stainless steel, caused by the litigation which has been reported in the papers. An important decision has just been given

in the French Courts, revoking the validity of the patents in that country. No doubt that will lead to similar decisions in other countries. The possibilities of this steel are becoming more apparent. It has been used chiefly for luxury purposes, but its use for constructional and engineering purposes is being developed, and the prospects on these lines are very good.

The financial reports of iron and steel companies which appear in the papers from time to time are not encouraging. The good ones are the exception. The figures bear convincing testimony to the unhappy state of the steel trade. It is only a question of time when more than one of the hitherto flourishing concerns will have to readjust their balance-sheets and make a new start. Two of the large engineering firms have taken this course during the past few days, and no doubt others will follow. After all, it is the best course. A huge debit to profit and loss account is like a millstone round the neck, and it is advisable to write it off boldly as soon as there is a definite prospect of making ends meet.

Some Inventions of the Month

By Our Patents Correspondent

Aluminium Alloys

THE British Aluminium Co., Ltd., and A. G. C. Gwyer, of London, have patented a process for converting "normal" aluminium-silicon alloys into "modified" aluminium-silicon alloys of improved physical properties, but without the use of fluorides of alkali metals. In this invention, the flux used consists of an alkali or alkaline earth oxide or hydrate. A "normal" aluminium-silicon alloy containing 10 per cent. of silicon is melted and treated with about 5 per cent. by weight of sodium hydrate. The latter is added in small portions which are forced to the bottom of the molten metal, and a strong reaction with rise of temperature takes place with each addition. If an alloy is treated in which partial "reversion" has taken place it is found that the quantity of sodium hydrate required may be considerably reduced—*e.g.*, to 2 per cent. See Patent No. 210,517, dated October 31, 1922.

Preparation of Ores for Leaching Process

A PROCESS has been invented by C. Hennes, of Berlin, for roasting ores in such a manner that the metals are readily recovered from the gangue by a subsequent leaching process. This is done by adding an oxidising medium such as saltpetre to the ore during roasting. In the case of ores such as pyrites containing lead, which cake together on roasting, the ore is given a preliminary roasting and is then disintegrated and roasted again with the addition of saltpetre. In the case of ores containing pyrites and silver in the form of silver glance, native sulphide, grey silver, or fahl ore (tetrahedrite) the saltpetre is added at the commencement of the roasting. In the case of complex blend ores, the saltpetre is added during the final stage of roasting. If silver containing blends and pure silver ore are treated, a muffle is preferably used for roasting to avoid contamination by the fuel. See Patent No. 210,824, dated October 10, 1922.

Cementation of Iron and Steel

AN improvement in the cementation of iron and steel according to the surface converting process has been patented by A. Gronqvist, of Copenhagen. The heating which follows the cementation process is not followed by a complete cooling in a hardening bath, but the metal is cooled only to about 300° C. The hardening bath contains sulphite lixiviation water and metal salts, and this produces a thick airtight crust of crystals on the article. The metal is then heated again to a temperature sufficient to vaporise the crystals, and is then quenched as usual. The hardening bath consists of sulphite lixiviation water of 35–50° Bé. 8 parts, disodium hydrogen phosphate 3 parts, potassium ferricyanide 0·5 part, potassium ferrocyanide 0·5 part, caustic soda 0·25 part, and water 6 to 8 parts. See Patent No. 210,870, dated November 8, 1922.

Chromium and Manganese Alloys

AKTIEBOLAGET FERROLEGERINGAR, of Stockholm, have applied for a patent for obtaining alloys of chromium and manganese low in carbon and silicon. Silicon-chromium and silicon-manganese alloys containing over 10 per cent. of silicon are first obtained by reducing the chromiferous and manganiferous slags resulting from the reduction of their ores. This is effected by means of silicon alloys of iron, aluminium, calcium, chromium or manganese. These alloys are then used for reducing the chromium and manganese ores. See Patent application No. 209,742, bearing the International Convention date January 11, 1923.

Improving Commercial Aluminium

A PROCESS has been patented by W. Rosenhain and J. D. Grogan, of the National Physical Laboratory, Teddington, for neutralising the effect of silicon which is usually present in commercial aluminium. This is done by adding a small proportion of another metal such as calcium to the aluminium to combine with the silicon, forming a compound which is insoluble in aluminium. The calcium may be added in the form of a calcium-aluminium alloy containing 8 per cent. of calcium, and the proportion would be such that 10 parts of calcium are added to 14 parts of silicon present in the aluminium. Barium or beryllium may be substituted for the calcium. As an example of this treatment, aluminium containing iron 0·14 per cent. and silicon 0·16 per cent. and having an electrical conductivity after annealing of 58·3 per cent. that of copper, was treated with 0·35 per cent. of its weight of calcium, yielding a product in which the conductivity is increased to 62 per cent. The calcium may be added during the process of producing aluminium by electrolysing alumina in molten cryolite, by adding some calcium fluoride. See Patent No. 211,027, dated August 17, 1922.

Iron and Steel Alloys

THIS process, patented by W. B. Hamilton, of Birkdale, Lancs, and T. A. Evans, of Manchester, relates to the manufacture of iron and steel alloys in which a mixture of aluminium and ordinary chrome ore is employed. The action of the aluminium is not entirely selective in reducing the iron oxide, and some of the silica is also reduced and the silicon finds its way into the bath of metal. In this invention, the quantity of aluminium employed is in excess of the chemical equivalent of the reducible metallic oxide, but only about 80 per cent. of the chromite is mixed with it. The remaining 20 per cent. of the chromite is added to a silicious lime slag in a highly fluid condition, and the 80 per cent. of the chromite together with all the aluminium is then added. The aluminium reduces all the reducible oxides, including the silica, contained in the chromite with which it is mixed. The silicon then reduces the 20 per cent. of chromite which contained no aluminium. It is thus possible to obtain an alloy which is substantially free from silicon. The operation is effected in an electric furnace with carbon electrodes, and the slag protects the molten metal from contamination by the electrodes. The same process may also be used with any reducing agent other than aluminium which is liable to reduce the silicon in the ore. See Patent No. 211,210, dated November 14, 1922.

Preparation and Smelting of Ores

A PROCESS has been patented by H. Diehl, of Darmstadt, Germany, for treating slags from lead and copper smelting furnaces containing iron, lime, magnesia, alumina, silica and some manganese, lead, zinc and silver. This material is smelted with such a proportion of lime or limestone, coke, and a chloride, that metallic iron is not obtained. The volatile metals are carried out of the furnace in the current of gases, and the greater proportion of the lead and zinc are thus obtained. The zinc product is washed by means of an alkaline wash water containing less than 0·2 per cent. of CaO. The zinc sludge is then saturated with carbon dioxide, the soluble chlorides are washed out with water, and the zinc product is calcined to remove chlorine, yielding a product which is particularly suitable for the production of zinc sulphate for electrolysis. See Patent No. 211,215, dated November 14, 1922. (Compare Patent No. 170,100, see THE CHEMICAL AGE, Vol. V, p. 634.)

Zirconium Steel

A PROCESS has been patented by H. E. Potts (communicated by Electro Metallurgical Co., of New York), for treating high-phosphorus steels to render them acceptable under the usual engineering specifications. The steels treated are those containing more than 0·10 per cent. of phosphorus for Bessemer steels, or 0·05 per cent. for open-hearth steels. It has been discovered that if zirconium is added in the proportion of about 0·02 to 0·50 per cent. of the steel, that the brittleness usually caused by phosphorus is eliminated. This beneficial effect is not due to the elimination of phosphorus, the proportion of

which is not reduced. It is also found that the zirconium-treated steel is more free from slag and oxide inclusions than ordinary steel. A large number of tests have been carried out to determine the strength and other properties of these steels, and it has been found in particular that they have a high Izod impact number compared with steel of similar composition free from zirconium; in fact, the impact number of such treated steel containing about 0·80 per cent. of carbon is about equal to the impact number of untreated low-phosphorus steel. See Patent No. 212,171, dated May 29, 1923.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

ALLOYS.—Perkin medal address. F. M. Becket. *J. Ind. Eng. Chem.*, February, 1924, pp. 197–205. Discusses broadly the field of ferro-alloys and certain alloying metals, viz., ferrosilicon, silicon metal, ferro-manganese, ferrochromium, chromium metal, ferrotungsten, ferro-molybdenum, ferrovanadium, ferrotitanium and zirconium alloys.

Molybdenum, its alloys and its applicability as an alloying constituent. Part I. P. Powell. *Brass World*, February, 1924, pp. 47–51.

SILVER.—The tarnishing and detarnishing of silver. Part II. G. W. Vinal and G. N. Schramm. *Metal Ind. (N. York)*, March, 1924, pp. 110–111. Causes of tarnishing and comparison of methods of removal; properties of moss silver.

ELECTRO-METALLURGY.—Developments in the separation of precious metals from their alloys. G. Eger. *Z. angew. Chem.*, March 13, 1924, pp. 137–144 (in German). Electrolytic separation of gold and silver from one another and from copper, lead and other metals.

CORROSION.—The corrosion of Muntz metal in sea water. W. Donovan and T. E. Perks. *J.S.C.I.*, March 28, 1924, pp. 72–75T. Deals with the relation between the micro-structure and "corrodibility."

The corrosive action of brackish waters on metals. T. E. Perks. *J.S.C.I.*, March 28, 1924, pp. 75–77T. Advances on theory of "varying salinity."

The natural water corrosion of steel in contact with copper. W. G. Whitman and R. P. Russell. *J. Ind. Eng. Chem.*, March, 1924, pp. 276–279. Results confirm the electrolytic mechanism of corrosion.

The electrochemical character of corrosion. U. R. Evans. *Brass World*; Part II, February, 1924, pp. 53–57; Part III, March, 1924, pp. 89–92.

SOLDERING.—Some properties of soft soldered joints. T. B. Crow. *J.S.C.I.*, Part I, March 21, 1924, pp. 65–68T; Part II, March 28, 1924, pp. 69–70T. Effect of varying conditions upon the resulting joins; theories of soldering. Bibliography provided.

IRON AND STEEL.—Metallurgical data on stainless steels. H. H. Abram. *Chem. Met. Eng.*, March 17, 1924, pp. 430–431. Investigation of their mechanical properties.

Detecting metallurgical defects in steel. F. C. Thompson. *Metal Ind. (Lond.)*; Part I, March 7, 1924, pp. 229–230; Part II, March 14, 1921, pp. 261–262. Examination by sulphur printing and macro-etching.

Stainless iron, its manufacture and properties. *Iron Age*, February 28, 1924, pp. 649–650.

Metalloids in basic pig iron in basic open-hearth practice. Part II, C. L. Kinney. *Blast Furnace and Steel Plant*, March, 1924, pp. 150–153. Data showing the losses sustained when unnecessary quantities of silica or bases are used.

GENERAL.—The physical properties of metal at elevated temperatures. V. T. Malcolm. *Trans. Amer. Soc. Steel Treating*, March, 1924, pp. 256–275. Tensile tests at high temperatures of materials used in the construction of valves.

ELECTRO-PLATING.—Studies on electro-plating. Part II. The composition of plating solutions (concluded). W. E. Hughes. *Metal Ind. (Lond.)*, March 7, 1924, pp. 218–220. Describes the characteristics of a good plating solution.

ANALYSIS.—The estimation of carbon in aluminium. R. Hahn. *Z. Metallkunde*, February, 1924, pp. 59–60 (in German).

Estimation of alkali metals in aluminium and aluminium alloys. Prof. Schürmann and Dr. Schob. *Chem. Zeit.*, February 23, 1924, pp. 97–98 (in German).

Simplification of the separation of zinc from iron and aluminium. E. G. R. Ardagh and G. R. Bongard. *J. Ind. Eng. Chem.*, March, 1924, pp. 297–299.

The assay of zinc ores. Use of powdered magnesium for removing copper and lead. E. G. R. Ardagh and G. R. Bongard. *J. Ind. Eng. Chem.*, March, 1924, pp. 300–301.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act, of* 1908, *provides that every Mortgage or Charge, as described therein, shall be registered within* 21 *days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

DERWENT FOUNDRY CO. (1920), LTD., Derby. Registered February 18, £5,000 debentures; general charge. *£20,000. November 26, 1923.

EALING PARK FOUNDRY, LTD.—Registered March 15, £2,500 debentures, balance of £10,000; general charge. *£5,000. May 29, 1923.

FLEMING (FREDERICK) AND CO., LTD., West Vale, brassfounders. Registered February 19, mortgage, to bank; charged on properties at West Vale, near Halifax.

JONAS AND COLVER, LTD. (late SIR JOSEPH JONAS COLVER AND CO., LTD., and JONAS AND COLVER, LTD.), Sheffield, steel manufacturers. Registered March 13, £80,000 debentures (filed under section 93 (3) of the Companies (Consolidation) Act, 1908), present issue, £78,000; general charge. *£47,100, £180,000. November 22, 1923.

KRYN AND LAHY METAL WORKS, LTD., London, E.C. Registered March 13, £10,500 debentures, to A. E. Tilley, 8, Staple Inn, C.A.; charged on land and premises at Letchworth; also general charge. *Nil. December 31,1923.

LAMPLUGH IRON ORE CO., LTD., Whitehaven. Registered March 1, £15,000 debentures; general charge. *£10,426. October 3, 1923.

MUREX, LTD., London, E.C., smelters, etc. Registered February 29, mortgage (collateral to £31,363 5s. 2d. and further advances mortgage dated November 7, 1922) to bank; charged on Wennington House, Wennington. *£36,231 5s. 3d. October 17, 1923.

PARKER FOUNDRY CO., LTD., Derby. Registered March 10, £15,000 debentures dated January 29, 1924; general charge. *£15,000. February 29, 1924.

SMITH AND COVENTRY, LTD., Salford, ironfounders. Registered February 26, £2,000 second debentures, part of £25,000; charged on properties at Salford, etc.; also general charge. *£100,000 first debentures. August 31, 1922.

Satisfaction

PARTINGTON STEEL AND IRON CO., LTD., Irlam. Satisfaction registered March 18, £106,496, etc., registered July 20, 1911, and February 15, 1912.

Partnership Dissolved

OVERTHROW AND SANDERS (William Frank OVERTHROW and Percy Harold SANDERS), metallurgists and analytical chemists, Cotteridge, Kings Norton, in the county of Worcester, as from March 24, 1924, by mutual consent. Debts received and paid by P. H. Sanders, who will continue the business.

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor, THE CHEMICAL AGE, *8, Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

Metallurgist's Views on Coke Quality

COKE plays so important a part in the everyday routine of the blast furnace manager that it is to be wondered that the practical men representing both industries do not more frequently get together to discuss their common interests and problems. A useful example was at least set by Mr. J. A. Thornton, of Middlesbrough, when he recently gave the Coke Oven Managers' Association his views upon the actual quality of coke which is necessary for good blast furnace practice, and one has only to note the length and interest of the discussion to appreciate that the subject is by no means one in which agreement even on general principles has been reached. Mr. Thornton speaks with the experience of the pig iron manufacturer, and perhaps he was not very far wrong when he said that most producers of metallurgical coke contend that while blast furnace managers always reserve the right to themselves to say what they do *not* want, they invariably withhold any definite opinion as to what they *do* want. From the coke producers' standpoint this attitude is not exactly helpful, and from the detailed consideration given to the question of physical and chemical quality in Mr. Thornton's paper, it would seem that the blast furnace manager has a pretty accurate knowledge of his own needs. There is no doubt, though, that blast furnace requirements do vary considerably, and it appears that no really effective tests are available for determining what is good or bad coke mechanically, the very fact that variation exists making it difficult to set anything in the way of a standard. For instance, if a furnace normally operating on lumpy coke is changed on to a much smaller material the results are bad; but this may be due to blast pressure and furnace design being such as to call for lumpy fuel—the coke, therefore, can scarcely be blamed. There is, however, common ground for discussion between those in two industries which are so dependent, the one on the other, and one can only hope that Mr. Thornton's example may be followed by a permanent and profitable *liaison* between the two parties concerned.

Research Associations

SEVERAL research associations relating to branches of metallurgy have been formed since the war, not the least important of which is the British Cast Iron Association with headquarters in Birmingham. The machinery of financing a research association is familiar by now to most people. It consists in supplementing, by means of a Government grant, the subscriptions obtained by an appeal to the industry to be benefited, the proportions put up by the Department and the industry respectively being, as our American cousins term it, usually fifty-fifty. So far, so good; and it would seem as if there was some basis of justification for issuing the results of any researches undertaken only to those who have put up the half share in question. The fact would, however, appear to have been lost sight of that the Government quota is, in itself, derived from public funds. The result would seem to be that whereas the whole community shares, indirectly, in the expenses, any benefit derived from the research is confined to a section only; a section which has certainly contributed more in proportion than the rest, and yet, obviously not the whole. No secret benefit should accrue to any one section of a community from the expenditure of what are actually in the nature of a public fund, and the results of a research association should, as a matter of purely abstract justice and practical expediency, be at the disposal of all who might be benefited thereby.

Post War Stagnation

THE perfection of the methods for heat treating chromium and nickel-chromium steels in the manufacture of stainless cutlery, and some improvement in the manufacture and treatment of a very few special steels for such purposes as the making of aero parts, both aftermaths of the intensive technological progress evinced during the war, would seem to be the only new things technology has to show for the last half-dozen years. In all the larger and far more important issues; in the manufacture of coke and the recovery of by-products; in the production of iron and steel; in gas producer practice; in rolling, pressing and drawing, technology remains practically at a standstill, no further, certainly, than it was during the war. Can it be that those who have within their hands the direction of research have insufficient knowledge of, or acquaintance with, industrial needs? Or is it a law that technology must languish when industry languishes? For if this be so there must be somewhere operative a vicious circle of cause and effect. Whether industry as a whole stagnates and technology as a whole languishes, it remains eternally true that the manufacturer whose methods are technically better than those of his rivals will, in bad times as in good, prosper, relatively, in comparison with them.

The Economic Factor

A GLANCE at the programmes of most of the scientific and technical institutions in this country will show that they reflect in large measure the conditions prevailing economically; with a productive capacity far larger than economic conditions can absorb, with acute competition to dispose of the surplus, technology loses much of the incentive operating when demand is large and well sustained, labour scarce, and industry prosperous and remunerative. Pure science, reposing on a more even keel, and unaffected by labour conditions, strikes, social unsettlement, and similar disturbances, predominates in the programmes, proceedings, and publications of our scientific institutions, even in those which have, as avowed objects, the improvement of technology; and in no field is this tendency more strongly manifest than in metallurgy. Metallurgical technology is, with few exceptions, stationary; metallurgical science is progressing rapidly.

Technology versus Science

THE value of a technological process is, in the last resort, gauged solely by its economic result, and differs in this respect from pure scientific research work, the value of which is gauged in terms of the actual increase it may make to the common stock of knowledge. This increase may be positive, in the sense that it brings out new facts or paves the way for new discoveries, or it may be negative in the sense of merely confirming or disproving the results of earlier research along the same lines. Pure scientific research has, therefore, the continuous stimulus of the natural human craving for more light, and while in times of special stress, as, for example, in the late war, it becomes, under the pressure of necessity, the mother of invention, it responds at all times to a very real and very constant human need.

Sulphurising and Desulphurising of Metals

By B. Bogitch

The following article on "Sulphurising and Desulphurising of Metals by Basic Slags and Fluxes," translated from the French, was presented as a contribution to a general discussion on "Fluxes and Slags in Metal Melting and Working," held by the Faraday Society and the Institute of Metals with the co-operation of the British Non-Ferrous Metals Research Association and the Institute of British Foundrymen, on Monday, April 28, 1924.

The sulphurising of metals takes place principally in the fusion of minerals to mattes; desulphurising in the course of purifying metals, notably during the treatment of steels in electric furnaces. In both cases, the slag or flux only intervenes in the reactions in proportion to its content of lime, free or in combination with sulphur. We can therefore express the reaction in the following form:—

$$MS + CaO + C = M + CaS + CO.$$

From this formula it can be deduced that for the desulphurising of a metal to succeed, not only is a basic flux necessary, but also an excess of carbon. For if the latter be not in excess, the calcium sulphide decomposes, and the liberated sulphur combines with the metal. An equilibrium, therefore, always exists in the distribution of the sulphur as between the metal and the flux.

Desulphurising of Metals in the Molten State

The coefficient of distribution of the sulphur for any metal is not known for certain. Even in a case as important as that of the desulphurising of steels, the distribution of the sulphur between the limestone flux and the molten metal is not known. In an effort to supply this information, we have carried out several experiments, of which the following is an account:—

Method of Operation: 100 grams of metal (copper, nickel, iron, manganese) with the addition of a corresponding quantity of sulphur, are melted in a graphite crucible at a temperature of 1,500°-1,600° C. in a small electric granular resistance furnace.

When completely melted 20 grams of desulphuriser (lime, limestone, flux, lime and fluor-spar) are introduced into the crucible, and agitated by means of a carbon rod. At the end of a given time, the metal is poured out, and the slag collected.

Desulphurising with Lime or Flux: If the metal be rich in sulphur, much of the latter is absorbed by the powdered lime. If, on the other hand, it contains a small percentage or fractions of a per cent. of sulphur, the desulphurising by pure lime or basic flux becomes extremely slow. With these desulphurisers there is no certainty at any moment that equilibrium is attained. This is accounted for not only by the high viscosity of basic fluxes, which makes diffusion of the lime or calcium sulphide very slow, but also by the feeble solubility of the latter in the fluxes. Thus, according to our experiments, a flux of composition $2SiO_2$, Al_2O_3, $2CaO$ can only dissolve 3·8 per cent. CaS, that is 1·7 per cent. S.

Desulphurising by Lime dissolved in Fluor-spar.—To obtain rapid desulphurising the lime must be dissolved in a solvent of which the properties are different to those of fluxes habitually used in metallurgy. Such solvent exists in calcium fluoride, indicated by Rollet.* Much less viscous than the ordinary basic flux, it can also dissolve more than 20 per cent. sulphur, and several parts per 100 of iron or manganese sulphide.

We give in the next column several results obtained with a desulphuriser composed in equal parts of calcium fluoride and lime.

With the desulphurising mixture indicated, the flux ceases to absorb sulphur when its content of this element is in the neighbourhood of 22 per cent. It is then almost solid at the temperatures used, 1,500°-1,600° C. Analysis showed that there still remained a little lime uncombined with sulphur in the flux. If the proportion of fluoride in the mixture be increased, the absorption of sulphur by the flux continues until all the free lime is transformed into sulphide.

The results of our experiments do not enable us to calculate exactly the coefficients of distribution of sulphur for the different metals which we have studied, but they give us nevertheless some indication of their order of magnitude. Thus in the case of iron, the sulphur absorption of the flux can be more than 500 times (five hundred) as great as that of the metal. For nickel or copper this coefficient of absorption is still greater (more than 2,000). With manganese, however, it is smaller than with iron.

Thanks to these coefficients being as high as they are, it is possible to prepare, at least in the laboratory, pure metals by separation directly from their sulphides, eliminating in consequence roasting and reduction.

* The fluoride may be replaced by chloride as has been proposed by Saniter.

Desulphurising of Metals in the Solid State

It has been noticed for a long time that certain metals—steels, for example—heated in a closed chamber in the presence of carbon, have their sulphur content reduced. Actually, this desulphurising is very slow, and affects only quite superficial layers of the metal. It is not therefore a method of practical importance for dense metals obtained by fusion.

It is quite otherwise, however, for metals like nickel or cobalt obtained industrially as agglomerates (cubes, rondelles, bricks). These are extremely porous bodies, consequently presenting considerable surface of action, though of small volume. In this case, desulphurising is much more rapid. It is produced both in the interior as well as the exterior of the agglomerate. In this way, very considerable changes can be effected in both the chemical composition and consequently in the mechanical properties of the metals.

Laboratory Experiments: Oxides of nickel or cobalt containing 0·01 to 0·02 per cent. of sulphur were ground to grains of a few hundredths of a mm. in diameter, made into a paste, and moulded into cubes whose sides were 15 mm. After drying, these cubes were submitted to a reducing calcination for varying times and at different temperatures.

As reducers, we used carbon (from sugar) anthracite and charcoal. Each kind of reducer was used in powder form, and either by itself or in a mixture with alkaline carbonates, or alkaline earths.

Below are some results of desulphurising at 1,100° C., after calcination for 12 hours:—

	Percentage Sulphur Content.
Oxides before reduction	0·018
Cubes after reduction in—	
Sugar carbon	0·019
Anthracite	0·028
Wood charcoal	0·010
,, ,, with 5 per cent. $CaCO_3$ ..	0·005

Thus the reduction of these oxides by means of a very pure carbon, such as is obtained by sugar calcination, does not result

Duration of Experiment in Minutes.	Sulphur Content in 100 Parts of Metal.		Sulphur Content in 100 Parts of Flux.
	Before Desulphurising.	After Desulphurising.	
	Iron.		
20	6	0·35	21·23
30	1·7	0·015	8·15
	Nickel.		
30	7·2	1·61	21·78
30	4·1	0·006	16·68
	Manganese.		
45	1·4	0·04	2·90

in desulphurising; furthermore, anthracite containing originally 0·50 per cent. sulphur gives up its sulphur to the metal; on the other hand, wood charcoal, especially when mixed with carbonates, reduces very perceptibly the sulphur content of the metal.

A more profound study of the question has shown that desulphurising does not begin until after the complete reduction of the oxides, and simultaneously with the carbonisation, that it is due to the presence of carbonates, and that consequently any form of carbon with addition of this salt will suffice.

If in the experiments mentioned above the wood charcoal acts when alone, it is because its ashes were already rich in carbonate.

Although in our experiments only small quantities of sulphur—0·013 per cent. in the most favourable case—were removed, the results are nevertheless very interesting because this desulphurising, although slight, appreciably modifies the mechanical properties of the metal. For instance, a nickel tube containing before desulphurising 0·015–0·020 per cent. sulphur is reduced to dust at the first blow of a hammer; but the same cube, other things being equal, but with 0·005 per cent. sulphur can be transformed by hammering into a disc of a few mm. in thickness, without breaking.

Melting for Mattes and Formation of Obstructions

Let us take the case of metallic oxide or silicate which is to be transformed into a matte by melting with calcium sulphide in a blast furnace. There is nothing peculiar or difficult in this case in the calculation of the charge. On the other hand, the control of the furnace is specially delicate on account of the frequent formation of obstructions or "bears." At times the "bear" increases to such a size as to reach the hearth and block the tapping holes, resulting in the forced stoppage of the furnace.

Up to now the formation of these obstructions has been attributed to momentary and accidental cooling of the furnace, which caused the solidification of the molten materials in the interior of the hearth. It must be remembered that if this explanation holds good in certain cases, it is insufficient in the case of blast furnaces used for smelting minerals to mattes. In this latter case the formation of the "bear" is always preceded by the separation of the molten metal into two layers; that with a high sulphur content (S=12-20 per cent.), very fusible and light; the other with less sulphur (S=3-5 per cent.), less fusible and heavy, solidifying easily at the bottom of the hearth, and giving a "bear." From this it is obvious that to prevent the production of "bears" it is necessary before anything else to stop the separation of the metal into two layers.

We have previously shown that the fusion of sulphides in the presence of lime, and an excess of carbon, creates an equilibrium in the disposal of the sulphur, so that the greater part of the latter combines with the lime and very little with the metal.

What happens if the carbon added to the mixture to be melted is not in excess? To start with, the distribution of the sulphur will vary in proportion to the quantity of carbon; the less carbon, the more sulphur will there be in the metal, the converse also holding good.

The laboratory experiments which we have carried out on this subject have confirmed the rule laid down above. In effect, by melting oxides of iron and nickel with calcium silicate and calcium sulphide we have obtained metallic specimens containing from 3–20 per cent. sulphur, depending upon the quantities of carbon introduced into the mixture to be melted.

Let us consider now a horizontal section of a blast furnace, in the region of the tuyères, for example. In this section the temperature and the atmosphere are evidently not the same at every point. The nearer the centre of the furnace the more the gases which circulate there are rich in carbonic oxide and poor in carbonic acid. There exist therefore in the interior of the furnace zones with greater or less reducing properties; in consequence, the composition of the matte obtained will vary from one point to another at the surface; towards the periphery the matte will be rich in sulphur, at the centre poor.

If the furnace is constructed and operated so that the in-blown air can be penetrated right to the centre (rectangular water jacket greatly extended), the proportion of metal of low sulphur content will be relatively small. The less fusible metal, moreover, will be dissolved without difficulty in the hearth by the matte containing much sulphur, produced in the zones at the periphery. On the other hand, in a furnace of large diameter, functioning at high temperature, the quantity of metal poor in sulphur will be considerable. The latter is constantly settling in the hearth, and one finds that in this case the furnace tends to form "bears" on the slightest cooling.

Oxy-Acetylene Welding of Cast Iron

Mr. C. Coulson-Smith, in a contribution recently before a conference of the Faraday Society, dealt with the above subject, and the notes below are abstracted from his paper.

THE actions which take place in the oxy-acetylene flame are as follows:—

Two molecules of acetylene require for complete combustion five molecules of oxygen and this reaction takes place in two stages:—

(1) One molecule of acetylene unites with one molecule of oxygen, forming one molecule of hydrogen and two molecules of carbon monoxide.

(2) This carbon monoxide on combustion yields carbon dioxide, and the hydrogen on combustion yields water vapour.

Avoidance of Oxidation

An average grey iron analysis is as follows:—

Fe	92·3	per cent.
Graphite C	2·99	,,
Combined C	·37	,,
Si	2·52	,,
P	1·08	,,
S	·02	,,
Mn	·72	,,

In cast iron, the oxidation of the iron itself, and of the other constituents, renders the welding difficult, and a process of puddling the molten metal is generally resorted to. The point of interest to us, however, is that oxidation occurs, a slag having a higher melting-point than that of the metal itself is formed, and being more dense, sinks through the molten metal, and may be incorporated in the weld if not removed by some chemical means, such as the flux provides. The actual influence which the oxide exerts is to increase the surface tension. The surface tension of the metal is low, and the object of using the flux is to overcome the excess set up by the oxide formation, so as to bring the oxide to the surface. The constituents of the flux either dissolve this substance, or float it off along the line of weld. All care should be taken to avoid excessive oxidation, but no matter how great the precaution taken it cannot be totally avoided. In foundry practice, limestone is used, the object of this in the blast furnace production of iron being to obtain a less siliceous slag, low in iron content and more fusible. The limestone adds lime to the free silica and the ferrous silicate constituents, thereby increasing the fluidity and lowering the temperature of slag fusion. If too much limestone is added the slag becomes refractory and the metal loses silicon, iron, and manganese, and a white iron is formed. Now similar results are obtained in welding, provided an efficient flux is not used. The fluxes used are many, but it must be remembered that the melting-point of all fluxes must be lower than the melting-point of the metal to be welded. The most general constituents of the fluxes for cast iron are mixtures of sodium borate, sodium carbonate, sodium bicarbonate and silica; as reducing agents one sometimes finds incorporated a trace of aluminium. The reactions which take place are, I think, as follows:—

The silica reacts with the sodium carbonate, forming sodium silicate. This in turn reacts with the sodium borate forming a borosilicate and free borax which, being a solvent for oxide iron, forms ferrous silicate. When this molten ferrous silicate is exposed to the air partial oxidation takes place and crystals of Fe_3O_4 are formed, and such a slag in contact with the impure metal gives up its excess of oxygen (from the Fe_3O_4) to the oxidisable elements present and again becomes reduced to ferrous oxide. In the welding of cast iron, ferro-silicon rods are used as filling material, which contain approximately 3 to 3·5 per cent. silicon, and this replaces or can replace any loss of silicon. Titanium as an ingredient is also made use of, especially on account of its combining property with nitrogen.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

A New Type of Steel

THE event of the past month has undoubtedly been the reading of an important paper by Messrs. Barr, Martin and Wall, before the Institution of Naval Architects, the subject being mild steel of high elastic limit. It has been only in comparatively recent years that simple and accurate workshop means for ascertaining the elastic limit have been available, reliance on the value of steel as compared with iron in constructional engineering having been based almost wholly on its admittedly greater tensile strength. It has, of course, been known for many years past that the difference between elastic limit and tensile strength is, in many cases, enormous, but the metallurgical conscience has hardly been sufficiently awake duly to appreciate all that this implies. Mild steel has changed its character of recent years and the discrepancy has become more profound and more suggestive, so that the value of the elastic limit has been far lower than that of the yield point, with which it can, and may, be confused with possibly disastrous results. Elastic limit is more or less a constant, whereas the yield point varies greatly according to the factors operating: composition, rate of stress, and other physical properties. This being so, it has long been evident that reliance upon ultimate stress, elongation and bending is inadequate to determine, within the limits of due safety, the mechanical properties of structural steel, and in no field has the result been more fraught with danger than in shipbuilding and construction.

Elasticity and Ultimate Strength

THE new "high elastic limit mild steel" has an elastic limit of at least 100 per cent. higher than ordinary mild steel. With an ultimate strength of 30 to 35 tons per square inch the elastic limit ranges from 16 to 17 tons per square inch without detriment to its ductility. It is capable of withstanding alternating stresses which would lead, in ordinary steel, to failure, while for all practical purposes in respect of handling and application it corresponds with ordinary mild steel, although its cost is higher. The authors omit from their paper all details as to chemical composition, neither is there any hint as to the process of manufacture, or other means employed to secure the result claimed. This is the more to be regretted as it gives the paper an empirical character, and in this critical age a series of ex-parte statements require more than their mere assertion to secure acceptation. In the result it is not perhaps surprising that the reception accorded the paper was somewhat chilly. It drew, from one of the authors, the admission that the new material was a "heat-treated" steel, but this much abused description conveys little solid information. Moreover, Mr. Service pointed out in the ensuing discussion that equally good, if not better, results had been obtained by Messrs. Beardmore, and it was further pointed out that some confusion was involved as to the relative bearings of the terms elastic limit and limit of proportionality. It may be doubted whether "elastic steel" will revolutionise engineering practice, although it is all to the good that the need of high elastic limit as distinct from mere ultimate strength should be emphasised, and that efforts should be directed to secure a material which, while not unduly costly, should be more reliable in service, and possess a higher factor of safety.

Methods of Analysis

THE United States Bureau of Mines have issued a Bulletin containing a number of recommended methods for the analytical determination of some of the rarer elements, such as cerium, thorium, tungsten, vanadium, radium, uranium, titanium and zirconium. Many of the text-book methods for conducting analyses for these substances are admittedly rough, and while the files of chemical journals supply a certain amount of newer information, the chemist who is called upon suddenly to carry out a determination of this nature is often at a loss for the necessary information. Now that so wide a range of "special steels" exists, no works laboratory can be deemed efficient in which work of this nature cannot be carried out accurately and expeditiously, and the modern works chemist is called upon to analyse completely a variety of metals and alloys which would have taxed very severely the laboratory resources of even a few years ago.

Standard Methods and Standard Samples

STANDARD methods are very desirable, but they are not, however, ends in themselves. The ultimate end is a complete analysis of what is often a very complex substance, and while a proper method is, of course, essential, means have to be devised for carrying it out properly, which is often a very different matter. It then becomes necessary to check the method itself, and this can only be done by applying it to a substance similar to that which it is required to analyse, and containing definite and known amounts of the element it is required to determine. The use of such chemical standards can alone serve to check not only a standard method but the manipulations involved, and the all important individual idiosyncrasies which intrude so obstinately in final results. The Iron and Steel Institute and the National Physical Laboratory have been collaborating to issue a series of samples of steel, to be known as British Standardised Steel Samples, each guaranteed, as the result of many series of analyses by practical analysts, on samples the uniformity of which is most carefully checked, to contain definite percentages of particular elements. Several such samples are now available. They consist of normally constituted steels guaranteed to contain, specifically, in the case of each sample: sulphur, 0·027% and sulphur, 0·071%; carbon, 0·65% and carbon, 0·10%; and phosphorus, 0·029% respectively. These constituent elements of ordinary steel present little difficulty in accurate determination at the present day, although it is well to have such standards as will serve to check the routine results obtained in works practice. It is to be hoped that before long standards can be issued containing guaranteed percentages of the special alloy elements whose determination often presents problems of real difficulty in the works laboratory. With well selected methods such as those recommended by the United States Bureau of Mines and British Steel Standards of corresponding compositions, many of the chemists' present-day difficulties would be solved, and a given analysis could be well and truly relied upon as an accurate determination of the real composition of the material to which it referred.

Vanadium

SOME useful notes on vanadium appear in Bulletin 212, recently published by the Department of the Interior, through the U.S.A. Bureau of Mines. The chief deposits of vanadium, by far the most important in the world, are at Minasragra, Peru, 20 miles from Cerro de Pasco, but there are others at San Miguel County, south-western Colorado; in Huerfano County, Colo., near the Sangre de Cristo Range; and elsewhere. Vanadium is used chiefly in steel for purposes requiring great toughness and torsional strength, such as automobile parts, gears, piston rods, tubes, boiler plates, transmission shafts, bolts, gun barrels, gun shields, and forgings that have to withstand heavy wear and tear. The vanadium content of such steels ranges from 0·1 to 0·4 per cent. Vanadium is also used occasionally in certain tungsten alloys for making high-speed tool steel, as the introduction of a small proportion of vanadium reduces the proportion of tungsten required to give the alloys the desired hardness and toughness. Vanadium differs from tungsten in having a beneficial effect not only on tool steel, but also on structural steel. It has been shown that vanadium does not form a double carbide with iron, but gradually takes the carbon from the carbide of iron until carbide cannot exist, if 5 per cent. of vanadium is present, and only a vanadium carbide containing 15 per cent. of carbon is present; this constituent is constant, at least in tool steels containing 5 to 14 per cent. of vanadium.

Structural Alloy Steels

CHROME-VANADIUM steels and chrome-vanadium-molybdenum steels are the latest development in structural alloy steels that have gained an extensive market. Almost all

these steels are made in the open-hearth furnace, chromium and vanadium alloys being added shortly before casting. In their physical properties these steels are much like chrome-nickel steels, but they have a greater construction of area for a given limit. Most of the chromium-vanadium steels made go into automobiles. Some manufacturers prefer them because of their greater freedom from the surface imperfections, notably seams, which the steels that contain nickel are likely to have. Some chromium-vanadium steel, which is not face-hardened, but has high resistance imparted by heat treatment, is used in armour plate of medium thickness. Vanadium is used to some extent in making bronzes, in medicines, and in dyeing. Methods of analysis that are applicable to vanadium ores and their products, and which have been tested by the Bureau of Mines, are described in Bulletin 212, "Analytical methods for certain metals," copies of which may be obtained from the Superintendent of Documents, Government Printing Office, Washington, D.C., at a price of 40 cents.

India's Steel Industry

PROPOSALS for the granting of protection to the Indian steel trade are contained in the first report of the Indian Tariff Board, which has just reached this country. The report states that inquiries have satisfied the Board that India possesses great natural advantages for the production of steel and iron. No better proof of this, the report states, can perhaps be given than the fact that she already produces pig iron more cheaply than any other country in the world. At present this advantage is lost owing to the higher cost of the subsequent processes. The market for steel in India is not comparable to that which exists in European countries or in America, but large quantities of steel are imported annually. The total consumption of iron and steel in India may be put in the neighbourhood of a million and half tons, and of steel only at about a million tons. With the expansion of demand which may be expected in the next ten or fifteen years, provided there is an adequate extension of transport facilities, there would be room for two or three steel works, each with an output comparable to that of the works at Jamshedpur. "Our deliberate opinion, the report states, is that, without the help of protection, the steel industry is not likely to develop at all."

The Committee propose (1) a 25 per cent. *ad valorem* duty on manufactured steels generally, but excluding certain vessels and all vehicles with few exceptions; (2) a 25 per cent. *ad valorem* on switches and crossings; (3) a specific duty of 40 rupees a ton on spikes and tie bars. Further proposals are bounties on the manufacture of wagons in India; a specific duty of 60 rupees a ton, equivalent to 15 per cent., on tinplate; that barbed wire and stranded fencing wire should remain subject to the present duty of 10 per cent., *ad valorem*, and that on all other wire and wire nails a specific duty of 60 rupees a ton should be imposed. With regard to agricultural implements it is proposed that the present *ad valorem* duty be raised to 25 per cent. on picks, powrahs or kodelis, and hoes.

The Use of Molybdenum

MOLYBDENUM is a metal that has come into considerable prominence during the last few years. Up to a few years ago its main uses were in connection with the manufacture of magnet steel and chemical salts, such as ammonium molybdate and molybdic acid. The war, however, brought molybdenum into prominence owing to its use in a number of special steels that were the result of considerable experimental work. A very complete investigation has been carried out in the United States of the sources and uses of molybdenum, and a report has now been issued by the Bureau of Mines, in Bulletin 212, which may be obtained from the Superintendent of Documents, Government Printing Office Washington, D.C., U.S.A., for 40 cents. The investigation showed that the United States probably had some of the largest, if not the largest, deposits of these ores in the world. The two principal ores are molybdenite, or the disulphide, and wulfenite, or lead molybdate. There is frequently associated with the disulphide the mineral molybdite, or molybdic ochre. This is an oxidation product of the sulphide. The former mineral is usually found in flakes somewhat similar in appearance to graphite, although some molybdenite ores carry the mineral in a more or less granular form. Wulfenite crystallises in tabular form which is usually yellow or orange although it may have a reddish tinge. Molybdite is a canary-yellow mineral which looks somewhat like carnotite. Powellite is not a commercial mineral, and is frequently found associated with tungsten.

Molybdenum is principally used in the manufacture of special steels and alloys. It is also employed in the manufacture of chemical reagents, dyes, glazes, and disinfectants. Molybdenum steel is used for crankshaft and propeller-shaft forgings, high-pressure boiler plate, rifle and gun barrels, armour plate, magnets, and iron for resistance furnaces, and in connection with chromium, vanadium, and other alloying elements in self-hardening and high-speed machine tools. The analysis of molybdenum products is frequently difficult, owing to the number of other elements that may be associated with this metal. Some of the alloy steels are complicated, and the following elements may be encountered in molybdenum ores and alloys: Cobalt, chromium, nickel, iron, manganese, tungsten, vanadium, titanium, zirconium, copper, aluminium, zinc, carbon, silicon, phosphorus, arsenic, antimony, and bismuth. The bulletin mentioned above also contains well-tested analytical methods for molybdenum and various other rare metals.

A Unique All-Metal Building

AN interesting feature has been provided at the British Empire Exhibition at Wembley by Fredk. Braby and Co., Ltd., who have erected a two-flatted all-metal building in the Eastern Section, facing the outer circle avenue, near the Giant Switchback. It is a beautiful and striking structure showing the application of metal for a variety of building purposes. It includes steel trusses on the unit principle with a roof of stamped zinc tiles and having copper hips and ridges; also a copper dome. The outside walls are entirely built of steel and copper. The steel sheet panels are neatly fitted in sections to represent stone work. The floor is of simple and economical construction, being of pressed steel filled in with composition or concrete, thus doing away with wood. The windows are of various attractive designs in steel and bronze. The stairs are of pressed steel on the unit and interlocking principle, very simply, quickly and easily erected, one flight of stairs being put together in a few minutes. The building has an ornamental bronze balcony and frontage, also bronze entrance doors. The interior walls are filled in with steel cabinets, lockers, storage bins, steel shelving and other steel furniture. There is a large display of zinc and aluminium products of every description. The design of the building is due to Mr. W. Braxton Sinclair, F.R.I.B.A.

Future Developments in Metallurgy

THE third Sorby lecture, which was delivered by Dr. Walter Rosenhain, of the National Physical Laboratory, on "Present and Future Problems in Metallurgy," has been reprinted as a pamphlet (price 1s.), and contains a number of interesting suggestions worthy of consideration by metallurgists. The author makes out a case for the establishment of a metallurgical research institute, where the enormous field of the study of the properties of alloys could be tackled systematically. So much has been done by the addition of small quantities of other elements to alter the properties of iron, and actually so little is known of the causes of these alterations, that Dr. Rosenhain suggests, for example, that if some other metals were treated in the same way immensely valuable advances might be made. A particular example taken is a comparison between iron and tungsten. Tungsten is many times harder than iron, yet by adding suitable metals or by heat treatment iron becomes very much enhanced in hardness. If tungsten could be studied in the same way, though there would obviously be immense practical difficulties, it is conceivable that a substance of phenomenal hardness would result, capable of cutting hardened steel with ease. Dr. Rosenhain makes similar remarks in the cases of non-corrosive and magnetic steels, and altogether the lecture is full of suggestive matter for the metallurgist.

Blast Furnacemen's Wages

IT is announced that, under the sliding scale, the wages of blast furnacemen and ironstone quarrymen in the Midlands will be increased next pay-day by 1¼ per cent. on base rates.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE course of events in April did not bring a realisation of the fear with which the month opened. The disaster which threatened to throw the trade of the whole country into confusion has been averted. Yet the mere threat of it exercised a depressing influence, from which we are now happily recovering. As the day for the miners' decision drew near the possibility of a strike became more remote, and it was felt that there was little likelihood of a repetition of the 1921 tragedy. We have once again breathing space, and it is now the task of the experts to find some point at which agreement may be reached between the owners and the miners. A Court of Inquiry, which seemed to be the object aimed at by the men, has been set up, the outcome of which will be awaited with anxious interest.

The Coal Problem

Although there is no strike, the coal question is already adversely affecting the steel works. The price of coal has advanced; and if there are to be still further advances it will make one despair altogether of the future of the steel trade, to say nothing of the other industries concerned. The state of the iron and steel trade is largely a measure of the industrial health of the country; whatever is done to damage that trade reacts on the whole. The steel trade cannot hope to do any good with coal at its present price of over 25s. per ton. We remember the days when 8s. to 10s. was considered a good price, and even in those days it was not easy always to make ends meet. No one expects to get back to those low prices, but on the other hand the present prices are not justified. The talk of still higher prices would be ridiculous if it were not prophetic.

Unfortunately the works cannot carry on without coal, but there is still much to be done in the matter of economising in the use of it. The coal consumed per ton of steel made varies considerably in the different steel works up and down the country, and in strict economy lies the steel makers' only hope of making any attempt to meet, in some way, the increased cost. We know of one large works where by the use of waste gas from the blast furnaces the amount of coal consumed for steam raising has been reduced from several hundred tons weekly to less than 5 tons per week.

At the Court of Inquiry the President of the Mining Association, Mr. Evan Williams, put his finger on the chief cause of the present high cost of coal. He stated that he was prepared to prove that if there was the same output per person to-day as there was in 1914, the wages paid would be considerably in excess of the increased cost of living. There is the trouble, not only in the collieries but in the works also. The statistics of production show it plainly, and if one goes back further than 1914 the difference is still more pronounced. The policy in force seems to be the minimum of effort with the maximum of pay. So long as that spirit prevails the workers, as well as the employers, are bound to suffer. The reduced hours of working together with the slackening of effort are responsible for much of the increase in the cost of production. Sooner or later this will have to be changed, and if the change is not effected by the working of reason and commonsense the only other thing that will do it is starvation.

Higher Wages Costs

Side by side with the increase in the cost of fuel there is the certainty of higher wages cost. The movement to which we referred last month has been the subject of a long and patient discussion between the employers' and the men's representatives, and an agreement has been reached which has been one of give and take on both sides. Now practically every Union concerned in the steel trade is seeking to obtain higher wages for its members. When considering the low wages which some classes of men are getting it is not the rate of wages but the amount earned that needs taking into account. If all the works were on full time much of the dissatisfaction would be removed; but if shortage of work means low wages obviously no good can be done merely by increasing the rate of wages. That would make it more difficult for the manufacturer to obtain orders, and in the end the worker would be no better off. It cannot be too strongly emphasised or too often repeated that higher wages are incompatible with reduced output. Both must move together, either up or down.

Steel Trade Finance

As we have previously pointed out, the steel trade is in a precarious position, as anyone can see who reads the financial reports and the speeches made at shareholders' meetings. We are witnessing a struggle for existence. There were many extensions and developments undertaken in the War years which have since proved to be a hindrance rather than a help. There are works with new units which are too large, inefficiently arranged, and unsuitable for the work; others with modern labour-saving devices which require more skilled attention than the old staff displaced; and still others with new plant stuck in old surroundings and conditions in which it has no chance of being efficient. Eventually many of the old and altered plants will have to shut down, and only those which are highly efficient and working at the limit of economy will carry on.

Iron and Steel Trade

There has been little or no change in the iron and steel market during the month. The first two weeks showed a healthier tone in pig iron. The demand for Cleveland iron improved, stocks were cleared out, and some good export sales were made. Buyers were coming to the conclusion, which was a natural one, that the bottom had been reached, and that with the prospects of dearer fuel and higher wages they could scarcely go wrong in buying forward. It was, therefore, all the more surprising when one of the principal makers, about the middle of the month, reduced the price of Cleveland No. 3 iron from 95s. to 92s. 6d. Although the other makers tried to hold out for 95s. the lower price became the market quotation. It is difficult to see what good can be done by such a reduction. If the purpose was to obtain more orders it did not materially succeed. Its chief effect was to hold off probable buyers in the hope of getting further reductions. Surely the experience of the past few years has shown that there is a limit at which it is better to stop making than reduce still further. What is needed is a steady level, which will give the consumer confidence in placing his orders. In the Midlands values have been maintained, Any concessions in prices are rendered impossible by the fuel and wages costs.

Hematite iron remains about the same. Buying is restricted to practically everyday requirements, but now that the coal dispute is on the way to settlement and the shipbuilding trouble is over there are grounds for expecting an upward movement.

There has been an official advance of 10s. per ton in the price of iron bars in Lancashire and Yorkshire, and the price is firm. The demand has not fallen off, but the general opinion is that the difference between the price of iron bars and steel bars is too great to permit of any material improvement in the finished iron trade. The railway and wagon orders account for most of the work that is being done.

Finished steel shows no change in the official prices. Small bars remain at about £10 5s., sections at £9 15s. to £10, and plates at £10 5s. In each department there are makers who are willing to shade these prices to secure good orders Specifications are not forthcoming as the works would like them, excepting in thin plates and sheets, where the demand is still good. Steel for the motor car industry is also in good demand. Billets stand at £8 to £8 5s. in the Midlands and £8 10s. to £8 15s. in Sheffield. The price of Belgian billets has hardened considerably, and little is being bought.

A Quiet Market

The market has been rather quiet, naturally on account of the Easter holidays. Many of the works took the opportunity of shutting down for the greater part or the whole of the week. Still, the tone of the market may be regarded as firm. The absence of foreign competition on a large scale is a good feature. Continental prices have increased to an extent which makes it difficult for them to capture the business from the English makers, especially when the uncertainty as to quality and delivery is taken into consideration.

There has been some alarm at the possibility of the removal of the import duty of 33⅓ per cent. on imported motor cars.

That would be a severe blow to the motor-car industry in this country, which would, in turn, re-act on the steel trade. There is a good demand for motor car steel, one large firm alone buying over 2,000 tons of steel each quarter. It would be a pity to do anything to disturb this trade, which is one of the few cheerful features for the steel manufacturers. It seems still possible that, as the result of appeals to the Chancellor, his Budget proposals may be at least modified. The result of the vote taken in the Austin Co.'s works was interesting; out of nearly 6,000 workers only 33 voted for the repeal of the duty.

Contracts

There have been one or two noteworthy contracts placed during the month. Messrs. Armstrong, Whitworth and Co. have secured the order for the construction of a section 18 miles long of the East Coast main trunk railway in New Zealand at a cost of £461,050; and Sir W. Arrol and Co. are to build a bridge over the Usk at Newport for the sum of £140,275.

Further large railway orders have been given out. The London and North Eastern Railway Co. have ordered 290 coaches for use on the London suburban lines, the work being distributed amongst six of the wagon-building firms.

The Indian State Railway have ordered 4 tank engines from Messrs. Hawthorn, Leslie and Co., and 6 from Messrs. Kerr, Stuart and Co.; and the Vulcan Foundry Co. have received an order for 40 passenger engines and tenders for the East Indian Railway.

The Admiralty have allocated the orders for the new cruisers, one to be built by the Fairfield Co. at Glasgow, and the other by Messrs. Vickers, Ltd., at Barrow. The machinery for the three cruisers to be laid down at the dockyards has been placed with Messrs. Parsons Marine Steam Turbine Co., Messrs. Hawthorn, Leslie and Co., and Messrs. W. Beardmore and Co.

Some Inventions of the Month

By Our Patents Correspondent

Iron and Steel Manufacture

An application for a patent has been made by T. Levoz, of Heer, Belgium, for a new process for extracting iron from ore. The ore is mixed with a flux such as fluorspar, soda, borax, potassium bichromate, which melt below 1,000° C., and also reducing agents. The mixture is briquetted, and the ore reduced solely by external heating. The product is a siliceous iron-manganese carbide, containing more than 5 per cent. of silica, and less than 1 per cent. of carbon. This product is melted in a reverberatory furnace, and ferruginous bauxite is added to form a covering of aluminous slag. The product passes to another furnace where the alumina is converted into aluminium, yielding a product of iron-silicon-aluminium-manganese alloy without carbon. This product is heated in another furnace with ore or hammer scale, and low-melting fluxes. The silicon and manganese are oxidised, and the aluminium volatilised, leaving molten iron, which may be run off. See patent application 210,795, having the International Convention date, February 1, 1923.

New Pig Iron Refining Process

A new process for refining pig iron containing vanadium forms the subject of a patent application by R. H. von Seth, of Stockholm. The first stage of the process is carried out in a furnace with an acid or basic lining. Soda is added, and the refining is interrupted at the moment when a great part of the vanadium has entered the slag as sodium vanadate. The slag is removed, and used for the producton of vanadium compounds or vanadium. The refining of the iron is completed in a separate furnace. After removing the slag the iron is tapped into a ladle, the residue of slag is stiffened with lime and removed, and the iron then transferred to the second furnace. See patent application 211,111, having the International Convention date, February 9, 1923.

Treating Complex Zinc Ores

A patent application has been made by C. Clerc and A. Nihoul, of Paris, for an improvement in the process described in Specification No. 209,100 (see The Chemical Age, Vol. X, p. 250). In that process, complex zinc ores were treated with hydrochloric acid, but a mixture of hydrochloric acid and free chlorine is now used. Gold and part of the silver are converted into chlorides, the silver chloride being dissolved by magnesium chloride. The solution is treated with carbon dioxide in presence of an excess of ore, producing a suspension of calcium carbonate which is rapidly decanted with the liquor from the ore. The calcium carbonate is filtered off from the solution, and lead is precipitated by magnesium sulphate. Gold and silver are precipitated by adding copper, and the solution is treated as described in Specification No. 209,100, to obtain zinc oxide and magnesium chloride solution. The latter is converted into oxychloride, which is calcined to obtain the mixture of hydrochloric acid and free chlorine required. See patent application No. 211,841, having the International Convention date, February 24, 1923.

Treatment of Ores, etc.

Two applications for patents for ore-treating processes have been made by H. Skappel, of Peking. According to one specification, ores, smelter products, etc., particularly sulphides, selenides, tellurides, arsenides, antimonides, sulphosalts, matte, speiss, etc., are reduced with a metal having an affinity for sulphur, etc., and the sulphide is simultaneously or subsequently reduced by electrolysis or otherwise. In an example, zinc blende is reduced by impure aluminium, and the zinc distilled off, leaving pure aluminium sulphide and ferrosilicon. The aluminium sulphide is mixed with alkali sulphide, and treated with zinc at a temperature below its boiling point, yielding a zinc-aluminium alloy. Zinc is distilled off from the alloy, yielding pure aluminium. The sulphides may be reduced by silicon or titanium, and a pure titanium sulphide may be obtained if titanium ore is used. Pyrites may be reduced by impure aluminium obtained from bauxite or clay, and the silicon or titanium in the aluminium are converted into the sulphides. If aluminium is in excess, pure aluminium sulphide is obtained, from which aluminium may be obtained by electrolysis. Ores containing manganese, chromium, tungsten or vanadium may be smelted in an electric furnace with carbon, and the product used to reduce iron sulphide. The resulting sulphide may be electrolysed to obtain the pure metal or alloy. Pyrites containing zinc blende may be mixed with iron before the matte is electrolysed, to recover the zinc. The melting point of the electrolyte may be reduced by adding alkalis, ferrous oxide, sodium chloride, etc. Electrolytic apparatus for obtaining pure iron, lead, molybdenum, nickel, manganese, copper, sulphur, etc., is described.

In the second specification, ores, concentrates, metals, alloys, sulphides, selenides, tellurides, arsenides, antimonides, sulpho-salts, matte, speiss, phosphides, carbides, etc., are fused with a reagent such as a sulphide so that on cooling some constituents crystallise out. On solidification the whole mass is reduced to powder by treating with air, water, carbon dioxide, etc., and the mixture is afterwards separated by any known method. According to examples, pyrites having a small copper content is fused with 1 per cent. of sodium sulphide, and treated with air or water to separate the copper. Molybdenum sulphide is treated with iron and sodium sulphides to purify it. The process may be applied to the transformation of arsenical nickel-cobalt ores to matte, and to the removal of arsenic from various ores. Numerous other examples are given. See patent applications, Nos. 211,883 and 211,895, having the International Convention date, February 26, 1923.

Use of Charcoal in Blast Furnaces

A study of temperatures in blast furnaces using charcoal as fuel has been completed by the American Department of Interior Engineers at the Minneapolis Experimental Station of the Bureau of Mines. While nearly all the iron produced in the United States is from blast furnaces using coke fuel, some furnaces are being operated on charcoal. The charcoal iron is usually manufactured for special uses, as in parts of automobiles. The temperature data on smelting charcoal iron were needed chiefly for comparison in the general study of blast-furnace problems. It was found that the temperatures under which charcoal furnaces are operated are lower than is permissible in coke practice. Furthermore, it was learned that the principal factor in causing this difference is the low sulphur content of the charcoal compared with the higher quantity of sulphur present in coke. In fact, the effect of sulphur in the blast-furnace charge is even more important than was hitherto believed.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

CORROSION.—Effect of alkaline solutions on the corrosion of steel immersed in water. F. N. Speller and C. R. Texter. *J. Ind. Eng. Chem.*, April, 1924, pp. 393–397. Corrosion decreases with increasing concentrations of alkali, a protective film being initially formed.

Recent progress in the study of corrosion. J. N. Friend. *J. West of Scotland Iron and Steel Inst.*, February, 1924, pp. 74–83. A general survey of the most important advances of recent years.

ALUMINIUM.—The tensile properties of aluminium at high temperatures. T. Martin. *Metal Ind.* (*Lond.*); Part I., April 11, 1924, pp. 351-354; Part II., April 18, 1924, pp. 377–378 and 388. Experimental results with diagrams.

Aluminium; its occurrence, alloys and manufacture. G. A. Pariser. *Aluminium*, March 25, 1924, pp. 1–10 (in German).

SILVER.—The tarnishing and detarnishing of silver. Part III. G. W. Vinal and G. N. Schramm. *Metal Ind.* (*N. York*); April, 1924, pp. 151–152. Causes of tarnishing and comparison of methods of removal.

LEAD.—The production of antimony and lead. Part II. *Metal Ind.* (*N. York*), April, 1924, pp. 139–142. Description of the manufacture of white lead, litharge, orange lead and red lead at the works of Cookson and Co., Newcastle, England.

BRASS.—The constitution of brass. G. Masing. *Z. Metallkunde*, March, 1924, pp. 96–98 (in German).

ELECTRO-PLATING.—Diseases of nickel deposits. Part II., W. Voss. *Metal Ind.* (*N. York*), April, 1924, pp. 153–154. Tabulates symptoms, causes and cures.

Studies on electro-plating. Part III. Addition agents. W. E. Hughes. *Metal Ind.* (*Lond.*), April 11, 1924, pp. 345–347, April 18, 1924, pp. 369–372 and April 25, 1924, pp. 393–395. The use of addition agents in practice.

IRON AND STEEL.—Semi-steel. A. Campion. *Metal Ind.* (*Lond.*), April 11, 1924, pp. 357–358 and April 18, 1924, pp. 381–382. Properties, mixtures, melting and heat treatment.

High elastic limit mild steel and its general applications. G. W. Barr, F. G. Martin and A. T. Wall. *Engineer*, April 25, 1924, pp. 443–444.

Why caustic solutions make steel brittle. R. S. Williams and V. O. Homerberg. *Chem. Met. Eng.*, April 14, 1924, pp. 589–591. Causes and mechanism of failure of steel containers subjected to the action of hot caustic solutions.

The manufacture of acid electric steel for commercial castings. L. J. Barton. *Trans. Amer. Soc. Steel Treating*, April, 1924, pp. 369–398. Discusses in detail the selection and use of scrap metal, the charging of the electric furnace, the melting conditions, and the types of slags obtained.

Intercrystalline fracture in steel. R. S. Williams and V. O. Homerberg. *Trans. Amer. Soc. Steel Treating*, April, 1924, pp. 399–412. Discusses the failure in mild steel caused by the action of cathodic hydrogen or caustic soda solutions.

Influence of chemical composition on cast iron. *Metal Ind.* (*Lond.*), Part I., April 4, 1924, pp. 331–333; Part II., April 11, 1924, pp. 355–356; Part III., April 18, 1924, pp. 379–380; Part IV., April 25, 1924, pp. 403–405. The effect of the presence of silicon, phosphorus, sulphur, manganese and carbon.

ANALYSIS.—Volumetric estimation of molybdenum in molybdenite and ferro-molybdenum. G. G. Reissans. *Metall u. Erz*, March (2), 1924, pp. 118–120 (in German).

The determination of carbon in iron, steel and iron alloys by combustion in a stream of oxygen. H. J. van Royen. *Stahl v. Eisen*, April 10, 1924, pp. 393–397 (in German).

GENERAL.—High-power photo-micrography of metals. F. Rogers. *Metal Ind.* (*Lond.*), April 4, 1924, pp. 328–330.

Behaviour of metals under compression. H. I. Coe. *Iron Age*, April 3, 1924, pp. 996–999.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that may occur.

County Court Judgments

[NOTE.—The publication of extracts from the "Registry of County Court Judgments" does not imply inability to pay on the part of the persons named. Many of the judgments may have been settled between the parties or paid. Registered judgments are not necessarily for debts. They may be for damages or otherwise, and the result of bona-fide contested actions. But the Registry makes no distinction of the cases. Judgments are not returned to the Registry if satisfied in the Court books within twenty-one days. When a debtor has made arrangements with his creditors we do not report subsequent County Court judgments against him.]

HATTON BORE AND CO., LTD., Oak Foundry, West Bromwich, ironfounders. £17 10s. 6d. February 26, and £39 19s. 3d. February 27.

Mortgages and Charges

*[NOTE.—The Companies Consolidation Act, of 1908, provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.]*

AFRICAN MANGANESE CO., LTD., London, E.C. Registered March 31, £4,000 debentures part of £600,000; charged on certain concessions in Gold Coast Colony, also general charge. *£416,000. December 31, 1923.

LUTON IRON FOUNDRY CO., LTD. Registered March 27, £500 debenture to Sir F. Beauchamp, Woodborough House, near Bath; general charge (subject to prior charge). *£7,000. June 6, 1923.

RELIANCE (COVENTRY), LTD., metal founders. Registered March 31, £5,000 debentures; general charge. *£1,200. January 14, 1921.

SLINGSBY (WALTER) AND CO., LTD. (late THOMAS FARRAR, LTD.), Keighley, ironfounders, etc. Registered March 28, further charge securing all moneys due or to become due on current account, to Building Society; charged on iron foundry, etc., Woodhouse Road, Keighley, with machinery, etc.

SWAIN (ISAAC) AND NEPHEW, LTD., Salford, brassfounders. Registered March 27, £1,500 debenture to C. Swain, senior, 18, Howard Street, Eccles New Road, Salford; general charge.

WALKER (R. C.), LTD., Grimsby, ironfounders. Registered April 2, £650 mortgage, to Hewitt Brothers, Ltd., Tower Brewery, Pasture Street, Grimsby; charged on premises at West Dock Street, Grimsby. *Nil. February 1, 1923.

WRIGHT'S HAVELOCK FOUNDRY CO., LTD., Leicester. Registered April 3, mortgage to Bank; charged on properties at Havelock Street, Leicester, with plant, etc. *Nil. June 30, 1922.

Annual Meeting of the Iron and Steel Institute

THE annual meeting of the Iron and Steel Institute is to be held on May 8–9. The newly-elected president, Sir William Ellis, will deliver his presidential address on the first day of the meeting, and the Bessemer medal will be presented to Professor A. Sauveur, professor of metallurgy and metallography at Harvard University. The afternoon session and the greater part of the second day of the meeting will be devoted to the reading and discussion of papers. Further meetings announced are on June 3–6, at the Empire Mining and Metallurgical Congress to be held at the British Empire Exhibition at Wembley and the autumn meeting in London on September 4–5.

Modern British Blast Furnaces

AT the Empire Mining and Metallurgical Congress to be held at Wembley during the first week in June, Mr. Fred Clements will read a paper on "Modern British Blast Furnaces."

Monthly Metallurgical Section

Published in the first issue of "The Chemical Age" each month.

NOTICE.—Communications relating to editorial matter for our Monthly Metallurgical Section should be addressed to the Editor, THE CHEMICAL AGE, *8, Bouverie Street, London, E.C.4. Communications relating to advertisements and other business should be addressed to the Manager. Contributions will be welcomed from correspondents on any points of interest to metallurgists bearing on works practice or current research problems.*

The Empire Mining and Metallurgical Congress

THE Empire Mining and Metallurgical Congress which concluded its sessions at Wembley yesterday is an event of prime importance to the mining and metallurgical world and to the British Empire at large. To begin with, it was the first of its kind. Of International Congresses of a similar nature there have been many, and while valuable communications have been from time to time presented at such congresses their net result has been comparatively small, owing in large measure to the lack of solidarity of national interests, and more especially to the lack of a common language. Science is no doubt cosmopolitan and its boundaries independent of race or creed, but polyglot proceedings are undoubtedly a bar to that perfect understanding and clarity of thought so necessary in the conduct of scientific discussions, and it may be frankly admitted that many international congresses have been less fruitful of results than might have been owing to this very reason. In the Empire Congress that difficulty did not arise; it was emphatically an All-British gathering, and its language was the common heritage of all Britons from all parts of the Greater Britain that constitutes the Empire. In addition to this advantage it was imbued with that spirit of racial solidarity that has made the Empire what it is.

The Inaugural Meeting

THE inaugural session opened in the largest of the Conference Halls at the British Empire Exhibition on Tuesday, and was attended by close on 800 members, many of them from distant Dominions and Colonies. The president was Viscount Long of Wraxall, who, as late Secretary of State for the Colonies, was well qualified to take the chair at such a gathering. His address dealt with the mineral resources of the Empire and their relation to its prosperity and development, and he did due justice to this theme in a thoughtful survey which took into account all the industrially useful minerals and showed how self-sufficing—with perhaps the sole exception of oil—the Empire is. Possession is not, however, everything, and as Lord Long specially emphasised in the closing sentences of his address, we require also to have "the courage and the determination necessary to secure full development and all the wealth and prosperity which follow from the proper use of this vast heritage." It is to the mining and metallurgical engineer, and to the chemist, that we must look for the realisation of our material resources, and it was to a gathering consisting in the main of such persons that the words were addressed. It is necessary to remember, however, that the professional man is almost powerless by himself to transmute the natural riches of the Empire into available and current wealth. For this the business man, the capitalist, the promoter and the investing public must lend their aid, and it is well that the news of our mineral possessions and their potential capacity for the production of wealth should be loudly trumpeted forth in order to create the confidence and stimulate the interest of those who must ultimately subsidise the pioneer work necessary and bring it to fruition. Science may pave the way for, but cannot take the place of, industrial enterprise.

A Representative Meeting

LUCKILY, amongst those assembled there was no lack of the needed financial element, and it is in no small measure due to the fact that the Congress had succeeded in assembling just those interests chiefly concerned, the professional and the commercial, that its inception and realisation find their fullest justification. Of its success, no one of the large audience present at the opening session could have a moment's doubt, and the convening institutions, their councils, and their executive officials alike deserve unqualified praise for the manner in which the arrangements were carried out. Alike by tradition and in fact, mining is the older art; hence it has right of precedence in the title of the Congress, nor is it surprising that more papers are being submitted in the sections devoted to mining than in those allotted to the sister or daughter art of metallurgy. Both the metallurgy of iron and steel and the metallurgy of non-ferrous metals have, however, worthy programmes of their own and papers of an interest at least as great and real. Reference has already been made in these columns to the further objects which the promoters of the Congress have in mind, and it will suffice, in conclusion, to express the wish and belief that the first mining and metallurgical congress will prove, in the unique opportunity it has afforded for professional men to meet, to become acquainted with each other and with each other's needs and to discuss freely their mutual problems, hopes and difficulties, an unqualified success and the forerunner of other and equally successful congresses in the future.

Larger Blast Furnaces

IN an important paper which Mr. Fred Clements contributed to the Empire Mining and Metallurgical Congress, which opened in London on Tuesday and which closed yesterday, attention was drawn to the tendency for blast furnaces in this country to assume greater proportions and, consequently, to be capable of larger outputs. Mr. Clements pointed out that Great Britain is the despair of the metallurgist because, though wealthy in its industrially productive ore deposits, the variety of these deposits has rendered anything like uniform development of productive practice well-nigh impossible. The ore deposits, in fact, differ so greatly in character that each demands a special mode of treatment for successful results, and consequently for many years the development of blast-furnace practice was quiescent in this country, while that of America and the Continent was moving rapidly along their own lines. Great attention has, however, been paid to blast furnace design over here in the last ten years, and units are now in operation which compare favourably from an engineering point of view with those found in any other country. So far as the size of furnaces is concerned, the development which is now noticeable was inevitable in view of the need for greater economy, not only in fuel but in operating costs, and the experience which has been gained with the larger furnaces should do much to remove the reluctance which has been generally shown towards installing units of increased dimensions. Mr. Clements tells us fairly definitely that the argument that a small furnace is more easy to control, and therefore can be relied upon to give a more regular and superior class of iron, is not borne out by the facts.

The Purification of Bauxite

By W. A. C. Newman, B.Sc., A.R.S.M., A.R.C.S., F.I.C.

THE separation of aluminium from bauxite by the electrolytic process demands extremely pure raw materials, for there is no method of refining the metal when it is once produced, beyond that of melting and then skimming off such impurities as may rise to the surface. Any foreign elements remaining in the raw materials as they enter the bath will contaminate the final metal yielding an inferior product. Great care is therefore taken that the bauxite, the cryolite and the carbon electrodes attain a sufficient degree of purity. Most trouble is experienced in preparing the bauxite, for the removal of the iron and silicon presents serious difficulties, and at the same time is extremely important, as these two elements in particular have a profound effect on the physical and chemical properties of aluminium.

The number of patents which have been issued for the recovery of aluminium from its ores is very great, but among them all the electrolytic method is the only commercial survivor. Likewise, many ingenious processes have been devised for the preparation of pure alumina, but again there is practically only one in use at the present time on an extensive scale—the Bayer process. Three others remain, however, at isolated plants, viz., the Peinakoff, the Deville-Pechiney and the Serpek. In the last named the alumina is really a secondary product in the manufacture of ammonia from aluminium nitride.

The Bayer Process

The crude ore from the mines is crushed in rock breakers of the Blake or Dodge type to about ¼ in. size, and then calcined at a temperature of 350° to 400° C. in an inclined rotary steel cylinder, 33 ft. long, 3½ ft. diam., lined with firebrick. This rotates on three tyres shrunk on to the outside casing, and is driven by friction wheels on which the tyres rest. The crushed ore is fed automatically into the upper end of the cylinder in regular small batches, and the hot gases from a coal or gas fire pass upwards over the surface of the downward moving material. The inclination of the barrel can be adjusted, and serves to give some regulation to the length of time the ore is calcined. The greater the inclination the shorter the time of treatment, and *vice versa*. After emerging from the first, or roasting, cylinder, the bauxite falls into the head of a second cylinder, inclined still downwards, but in a direction reverse to that of the first. This serves as a cooling chamber, through which the gases pass on their way to the calciner, thus taking up additional heat from the descending ore.

Calcination is necessary for the following reasons :—

1. To remove the greater proportion of the moisture contained in the bauxite, which would otherwise tend to form a viscous paste, choking the screens during the final crushing. The subsequent solutions would also be diluted unduly.
2. The calcined material can be more easily crushed than the uncalcined.
3. To remove organic material, which would, if still present, render the precipitation of the aluminium hydroxide difficult.
4. To prevent the formation of soluble iron salts in the aluminate liquors, and to reduce the slimy hydroxide of iron which is objectionable in the filtration of the sludge received from the precipitation tanks.

It is essential that a temperature of 400° C. be not exceeded during calcination or otherwise the solubility of the aluminium hydroxide in caustic lye would be greatly impaired.

From the calciners the product passes to a series of ball mills in which it is crushed to 150–200 mesh. It is then mixed with caustic soda solution of 1·45 specific gravity (41 per cent. NaOH) in iron vessels, 5 ft. diam., 11½ ft. high, fitted with iron stirrers.

A ratio of 1 : 1 of alumina to sodium oxide would be the most economical, yielding a solution of the compound $NaAlO_2$, but this is not practicable, and a ratio of 102 : 108·5 to 114 is demanded, depending on the nature of the bauxite under treatment. With a less ratio a considerable amount of aluminium hydroxide is retained undissolved in the residue.

The mixture of caustic and bauxite is run into autoclaves, approximately 10 ft. long and 4 ft. in diameter, with a working capacity of about 3,500 litres. They are fitted with steam jackets, steering gear and the usual manometric and thermometric fitments. A pressure of 7 to 8 atmospheres and a temperature of 180°–220° C. are used. Three to four charges are worked in 24 hours. The efficient working of the autoclaves requires care and incessant attention, for there are many factors which may influence the ultimate result. The most important are :—

1. The temperature and pressure in the interior of the autoclave. These should not vary greatly from those specified above.
2. The intensity and efficiency of the calcination.
3. The chemical properties of the bauxite under treatment.
4. The fineness to which the material has been ground.

Usually about 95 per cent. of the bauxite is brought into soluble form, and the ratio $Al_2O_3 : Na_2O$ in the solution at the end of the operation is 1 : 1·75 to 1·85.

When solution is complete, steam under pressure is admitted into the autoclave, and the mixture blown out through a pipe inserted through the cover into storage tanks for the filter presses. Hot water and first washings from previous filtrations are here added in order to reduce the specific gravity to 1·23 (—25 per cent. NaOH), and the contents of the tanks thoroughly stirred.

The diluted solution is led to the first press under the pressure due to the head given by the height of the storage tank. This low head prevents suspended matter passing through the filter cloths. The main clarifying action takes place here, and the clear liquor is then sent to a settling tank, whence, after some hours' settling, it is despatched to a second, finer filter. The mud in the first press is given four washings with water and dilute alkali, the first or strongest runnings afterwards being used to dilute further charges from the autoclaves.

The difficulties which arise in filtration are mainly due to the principal impurities, iron oxide, silica and titanium oxide. The residue, or red mud, on the filter cloths contains some of the iron as $Fe_2O_3\,2H_2O$, especially if the calcination has been imperfectly carried out. This oxide is difficult to filter, as it readily passes through the cloths and remains in suspension in the filtrate. The titanium oxide forms insoluble sodium titanate Na_2TiO_3, with caustic soda, and this is converted into the acid salt $NaHTiO_3$ on washing with water. Silicic acid occurs partly as sand and partly as clay, or aluminium silicate. The former is scarcely attacked by the soda, and can practically be neglected. The clayey material is completely decomposed, however, and the silicic acid precipitated mainly as the silicate of composition $Al_2O_3,Na_2O,3SiO_2,6H_2O$. This precipitate has a peculiar tendency to increase the resistance of the filter cloths by blocking up the pores. Other difficulties in filtration lie in the correct regulation of temperature and velocity of flow. If the liquor be cooled too much, the tubes become filled with solid aluminate; if the solution passes through too quickly it remains turbid.

From the second, or finer, filter, the solution is pumped into precipitation tanks 20 ft. high and 13 ft. diameter, where it remains for about a week, during which period pure alumina from a previous batch is stirred in vigorously to cause the precipitation of the alumina held as sodium aluminate in solution. Two thirds of the latter are deposited and then separated in filter presses as a white amorphous solid. One third is washed carefully and then calcined in an inclined rotary furnace with a magnesite lining, at a temperature of 1,000°–1,100° C. This transforms the amorphous material into more crystalline grains, in which state it is less liable to absorb moisture during storage or transit. Dust carried away mechanically by the furnace gases is recovered in flues and reintroduced into the process. The second third which is pressed is not washed so carefully, but returned to the cylinder to act as precipitant for the next batch of aluminate solution.

The theoretical foundations of the precipitation process are a little obscure. Experiment has shown that similar effects may be induced by other finely divided material such as sand or powdered glass, which seems to suggest a form of catalytic reaction. The conditions for efficient precipitation have been carefully studied and attention is directed to the following points.

1. *Concentration of the Liquor.*—24° to 25° Bé is the maximum. At greater or less concentrations too little hydrate is

obtained. In properly precipitated liquor the final ratio $Al_2O_3 : Na_2O$ should be about 1 : 6 with a concentration of 22° Bé.

2. *Ratio of Al_2O_3 to Na_2O.*—The initial ratio is about 1 : 1·8 though the more nearly the ideal ratio of 1 : 1 is obtained the more favourable is the precipitation. In practice, as little excess sodium hydrate as possible is used and the liquor is passed to the precipitation tanks quickly.

3. *Temperature.*—This is of extreme importance and should be between 25° and 35° C. Below the lower temperature precipitation is too slow and above the higher a hydroxide is produced which is less active when used in a subsequent precipitation.

4. *Presence of Organic Substances.*—If such impurity is not removed in the original calcination it hinders precipitation.

5. *Method of Stirring.*—This influences the speed and completeness of the precipitation. Usually two small stirrers, revolving at 50 to 60 r.p.m., are placed in each tank.

6. *Condition of Precipitant.*—This should be finely powdered in order to provide an extended surface. Material precipitated above 35° C. is too coarse to give quick and complete separation.

The aluminate liquor recovered from the filter presses after the removal of the precipitated alumina is concentrated to 46° Bé in steam or double effet evaporators, cooled and allowed to stand for some time to enable the insoluble silicate $Al_2O_3 . Na_2O . 3SiO_2 . 9H_2O$ to settle. It is then decanted, centrifuged and passed to the storage tanks for the treatment of a fresh batch of bauxite.

Peniakoff Process

The old process involved the heating in a reverberatory furnace of a mixture of pyrite, bauxite and salt cake in proportions corresponding very nearly to those demanded by the equation

$$11Al_2O_3 + 2FeS_2 + 11\,Na_2SO_4 = 11Na_2O . Al_2O_3 + Fe_2O_3 + 5SO_2.$$

The sulphur dioxide was used for the manufacture of sulphuric acid or in the Hargreves process. The solid product was lixivated with water to dissolve the aluminate, filtered, and the residues thoroughly washed. The liquor was treated with carbon dioxide obtained as a by-product from limekilns, and the aluminium hydrate thus precipitated.

At the present time in the few instances where the process is used, small coal is substituted for the sulphide.

$$2(4Al_2O_3 . Fe_2O_3) + 8Na_2SO_4 + 5C = 16\,NaAlO_2 + 4FeO + 5CO_2 + 8SO_2.$$

The plant used is very similar to that for the Leblanc soda process. The mixture of coal, salt cake and bauxite is ignited strongly to 1,400° C. in a rotary calciner. The sulphur dioxide is oxidised catalytically by the ferric oxide present to sulphur trioxide which reacts with a mixture of bauxite and salt placed in a separate cylinder to form sodium sulphate. Carbon in the form of pulverised coal is added to this mixture and the cycle started again.

The conversion into aluminate is not so complete as in the Bayer process. Usually too much coal is added, which results in a lower recovery of sulphur dioxide and the formation of sulphide. Only about 75 per cent. of the alumina is recovered in a soluble form. The large amount of fuel used also enhances the cost of the process.

Serpek Process

This process depends on a reaction of the following nature :—

$$Al_2O_3 + 3\,C + 2N = 2AlN + 3CO$$
$$-391{,}600 \qquad +90{,}000 + 87{,}480 = -214{,}120 \text{ cals.}$$

The reaction is not appreciable below 1,500° C., and for its complete fulfilment an electric furnace must be used.

On the manufacturing scale rotary furnaces 180 ft. to 250 ft. long and 10 ft. to 13 ft. in diameter are used. The building of the oven itself is an intricate operation and is done by means of the nitride itself. A mixture of carbon and bauxite, moulded with the aid of a suitable binder into the form of a tube, is heated to a high temperature and producer gas blown through it. After a number of hours a crust of crystallised aluminium nitride is formed along the whole length, 20 cm.-30 cm. thick. Into the new tube thus formed new mixture is introduced, and the cycle of operations started. The central portion of the tube is heated electrically by resistors placed radially in the walls of the oven and arranged so that the heat radiation losses are minimised. The current is led in by two massive electrodes. The inclination of the furnace is about 1½ per cent., and the speed of rotation so adjusted that it takes one hour for material to pass through the heated portion. The nitrogen necessary for the reaction is led in as producer gas through a preheater in which the heat of the outgoing nitride is partially transferred to the gas. The nitride itself is a bad conductor at high temperatures, and the mixture must contain at least 30 per cent. of carbon to make it sufficiently conducting. The excess of carbon is burnt off in the air passing through the oven, and produces a rich gas (60 per cent. to 70 per cent. CO.) which is used to preheat the carbon-bauxite mixture and then burnt in the preliminary bauxite calciners. The reaction is only fairly started at 1,600 ° C. and proceeds rapidly at 1,700 ° C.

The action of water on the nitride thus produced is to produce ammonia and aluminium hydrate. The reaction is conducted in autoclaves under a pressure of 2-4 atmospheres, and proceeds more quickly if the water contains a little alkali aluminate in solution. Under these conditions the principal product is ammonia for which the Serpek process was originally intended. To produce pure alumina it is necessary to treat the nitride with 20° Bé sodium aluminate solution in an autoclave at two atmospheres pressure and boiling temperature for 2 to 2½ hours. Ammonia is evolved and is conducted away to be neutralised with sulphuric acid. The liquor in the autoclave is self-concentrated during the progress of the reaction to 40° Bé, and the alumina is dissolved. The clear liquor is decanted or filtered from the insoluble impurities, and the aluminium hydroxide precipitated by known methods —either by carbon dioxide or by pure alumina as in the Bayer process.

Deville-Pechiney or Dry Soda Process

This process was used in the early days of the industry, and still has claims where bauxite excessively high in iron has to be treated. It cannot be used, however, if much silica is present, owing to the large excess consumption of soda which that would entail.

The powdered bauxite is calcined and finely ground in ball mills. It is then mixed with 1½ times its weight of calcined carbonate of soda (giving a ratio $Al_2O_3 : Na_2O = 1 : 1·2$) and a proportion of pulverised coal. The mixture is sintered in a firebrick lined rotary furnace for four hours at a temperature of 1,200° to 1,400° C. Sodium aluminate and carbon dioxide are formed, and the former is cooled in a second smaller cylinder at the end of the first. When the evolution of gas ceases the mass is rapidly transferred to sheet iron or wooden vats fitted with stirrers. Quickness in this operation is essential in order to prevent premature precipitation of the hydroxide. The mixture is boiled for 10 minutes, well stirred, and a liquor with a gravity of 35° Bé thus obtained. The ratio $Al_2O_3 : Na_2O$ should be maintained at 1 : 1·8 and caustic soda is added if necessary ; or, as is more preferable, the crushed calcined product may be added to a boiling solution of soda of the correct strength to give the requisite gravity. The temperature should not be below 80°C. A small quantity of silica also passes into solution at this stage. It may be removed by heating the liquor under a pressure of seven atmospheres in an antoclave for five to six hours. The silica is precipitated as $Na_2O, Al_2O_3, 3SiO_2, 9H_2O$. Suggestions have also been made for the removal of the silica by the addition of sodium phosphate.

The insoluble residue, consisting principally of ferric oxide, is filtered quickly under ordinary pressure, and then washed with hot water as cold water causes the reprecipitation of aluminium hydroxide. The mud cakes are dried and used for gas purification. More importance is attached to performing a quick filtration than to getting a clear filtrate, and the operation is stopped when ferric oxide begins to pass through the cloths. The stronger washings are used with a fresh charge.

The filtered liquor, which is usually bright yellow in colour, and about 35° Bé, is allowed to settle for some hours, and afterwards precipitated by carbon dioxide gas in tall cylindrical vessels of nine to twelve cubic meters' capacity. The temperature is kept at 80° C. by a steam jet, and the hydroxide is obtained in a finely crystalline, easily filterable form, which is filter pressed, washed and calcined as already described for the Bayer process. The precipitation of nine cubic meters occupies about three hours. The soda liquors from the presses are concentrated, and the soda recovered to be used again for a later charge.

Metallurgical Topics: Monthly Notes and Comments

From Our Own Correspondents

The Wembley Congress

THE Empire Mining and Metallurgical Congress, which opened at Wembley on Tuesday, brought together a number of experts from all parts of the Empire, and delegates from the U.S.A. were present as guests. There was a comprehensive programme dealing with coal and metalliferous mining, petroleum, iron and steel, and non-ferrous metallurgy. At the commencement of the proceedings, after a congratulatory message from the King had been read, Lord Long, the president of the Congress, delivered an inaugural address, in which he reviewed the mineral resources of the Empire. In coal, which was the basis of the industrial activity of Great Britain, the output of Great Britain, which was 276,000,000 tons last year, was only inferior to that of the United States. Coal was now being mined in the Dominions in increasing quantities. In the case of oil the proportion of world supplies within the confines of the Empire was small, but there was still a very great potential source of oil within the Empire in shale deposits.

Dominion Ore Deposits

IN recent years the competition of richer or cheaper foreign ores, continued Lord Long, had seriously affected the home industry, but in 1922 the quantity of iron ore and ironstone raised amounted to nearly 7,000,000 tons. Iron ore deposits of a remarkable character existed in Australasia, though it was only within recent years that endeavours had been made to turn them to commercial use. In the various States of Australia actual iron reserves had been estimated to amount to over 344,000,000 tons, while probable and possible reserves were estimated as not far short of 600,000,000 tons. Canada possessed large resources of iron ore, the quantity available being estimated as in the neighbourhood of 300,000,000 tons. Newfoundland, the oldest Dominion, possessed deposits of almost every known variety of iron ore; two of the largest mines in the world were on Bell Island. The reserves there had been estimated at 3,250,000,000 to 3,635,000,000 tons.

After reviewing the Empire deposits of gold, precious metals, tin, etc., Lord Long then mentioned that Canada produced an overwhelming proportion of the world's output of nickel, and last year contributed 69 per cent., and New Caledonia 25 per cent., of the total. A conservative estimate of the proved ore in Canada placed the total at 70,000,000 tons, with a further 80,000,000 tons probable. It was satisfactory to know that the Empire was in the van as a producer of manganese, so valuable as a constituent in the manufacture of certain qualities of steel. The present time was opportune for an expansion of this branch of the metal industry. In the production of chrome ore Rhodesia led the world.

Education and Research

A NUMBER of valuable papers were presented, and particular interest attaches to two dealing with metallurgical education and research, which touch the foundations of metallurgical knowledge. Professor H. C. H. Carpenter, of the Royal School of Mines, it is significant to note traced to the Great Exhibition of 1851 the creation of a demand for scientific technical education, which resulted in the establishment of a technical school for mining and other branches of industry, especially chemical manufactures. This school was formed in the same year in connection with the Museum of Practical Geology in Jermyn Street, and was known as "The Government School of Mines and of Science applied to the Arts." Two years later the newly-formed Department of Science and Art endeavoured to meet the demand by widening the scope of the Jermyn Street school, and giving it the character of a centre for the prospective system of technical education, of which the mining school would naturally form only one branch. The system of instruction was organised in this sense, and the name of the school was changed to "The Metropolitan School of Science applied to Mining and the Arts." By 1863 this school had become the Royal School of Mines, and between 1875 and 1880 the departments of the school were transferred to a new headquarters at South Kensington.

Metallurgical Institutions

THERE are now 14 institutions providing courses in mining and metallurgy and the paper reviews the facilities provided at each of these in brief. For more than thirty years, however, the Royal School of Mines, Professor Carpenter points out, was the home of metallurgical training in this country. To-day the facilities for metallurgical training in this country are very considerable and, in Professor Carpenter's opinion, ample. Each of the Departments of Metallurgy in existence has its own special character, and every branch of the subject is now represented. Since Metallurgical Departments are expensive to found and to maintain, Professor Carpenter suggests should there be any further resources which may become available for education and research they should be devoted, not to establishing new departments, but to strengthening and extending existing ones. At six of the institutions there are two degree courses, the one extending over three years leading to a pass degree, the other over four years leading to an honours degree. At three institutions there is only an honours degree course, which in two cases extends over four years and in one case over three years. At one college there is only a pass degree course extending over three years. There is accordingly general uniformity throughout the country with regard to the length of the courses, three years being regarded as sufficient for a pass and four years for an honours degree.

Government Research

DR. J. L. HAUGHTON, who dealt with metallurgical research in Government Laboratories, mainly at the National Physical Laboratory, in introducing his paper said that research of this kind falls into three classes: (*a*) fundamental research undertaken to increase general knowledge of metallurgical facts; (*b*) research undertaken for the definite purpose of increasing the efficiency of the fighting services; (*c*) research undertaken to assist manufacturers in special problems. Though it is not possible to draw hard and fast lines, Dr. Haughton indicated how work in these divisions is undertaken. He pointed out that a considerable amount of fundamental metallurgical research is carried out in university laboratories. A small amount is undertaken by the Research Associations connected with the various metallurgical industries, and a certain amount is also carried out at the Research Department, Woolwich, if the solution of the fundamental problem will directly and obviously assist in the solution of some service problem, and in the same way fundamental research has been carried out at the Mint and at the Admiralty Engineering Laboratory; but it is practically true to say that the National Physical Laboratory is the only Government laboratory where pure metallurgical research is carried out mainly for the advancement of knowledge. This remark is, of course, no disparagement to the other establishments mentioned, in some of which research of great value and of a high order is continuously carried out.

Increasing Fighting Efficiency

THE second class of metallurgical research, that undertaken to increase the efficiency of the fighting services, is largely carried out at the Research Department, Woolwich, where a large amount of investigation is undertaken on materials used, or proposed for use in ordnance, armament, etc., and materials, e.g. special types of steels, are studied with a view to ascertaining their suitableness or otherwise for weapons of war. Failures, or anomalous behaviour of metallic objects in the services, should such occur, are submitted to the department for investigation and report (similar work is carried out at the Admiralty Engineering Laboratory, though here the metallurgical work is subsidiary to the engineering); while a very large amount of work for the fighting services was also undertaken by the Metallurgical Department of the National Physical Laboratory during the war, and a certain amount is still done there.

Research carried out to benefit the metallurgical industries is mainly in the hands of such bodies as the British Non-Ferrous Metals Research Association and the Cast Iron Research Association. (This, of course, excludes the research

laboratories owned by large steelworks, such as the Brown-Firth Laboratory.) These Research Associations have no laboratories of their own, and while an appreciable amount of their work is done at the universities, some is also carried out at such Government Institutions as the National Physical Laboratory and the Research Department, Woolwich.

Estimation of Uranium in Steel

FEW chemists are given much opportunity for experimenting on the methods adopted for the estimation of uranium. This is partially due to the fact that only certain varieties of tool steels contain this metal, and also because those which do vary considerably in composition. Standard text books on steel works analysis seldom provide more than one method for determining those rarer elements, which is often tedious and frequently entails the use of reagents which are not usually found in the average steel works laboratory. Uranium steels have not been applied to the same extent as other alloy steels owing to the high market price of the metal.

The results secured by these steels cannot be examined with the same accuracy when no reliable and moderately rapid method of analysis is known. A step was taken in the right direction when the method of removing iron in the unoxidised state was employed. The remainder of the determination, however, was not carried out as expeditiously as is usually expected in works laboratories. By careful addition of ammonia to ferrous solutions of steel, a point can be reached where uranium, etc., is completely precipitated, whereas only a small proportion of the iron is separated. This principle of working can be applied to many other estimations besides that of uranium, as already pointed out. To complete these methods satisfactorily a system of qualitative tests should be made to allow the operator to avoid unnecessary separations when no other rarer elements are present.

A Method Described

THE following method supplies an accurate means of determining uranium which is also comparatively rapid. The weight of metal to be used rests with the amount of uranium expected to be present, but usually ranges from five to ten grams. The drillings are placed in a 20 oz. flask and dissolved by boiling in dilute sulphuric acid (50 per cent.). When dissolved, the residue is filtered off and washed with hot water, the filtrate being collected in a large-sized beaker. After drying the residue, it is ignited in a platinum crucible at a moderate temperature, after which it is cooled and digested in hydrofluoric acid containing a few drops of sulphuric acid. The mass is evaporated over a hot plate in a fume cupboard until fumes of sulphur trioxide are thickly evolved. After cooling, water is added and the crucible heated until all soluble matter has gone into solution. This solution is filtered if necessary, and transferred to the beaker containing the previous filtrate. The combined filtrates are diluted considerably and dilute ammonium hydrate run in from a burette with constant stirring. When a slight precipitate forms, the addition is made with greater care until the colour assumes a darker tint, the mass principally consisting of uranium hydrate, together with only a small portion of the iron.

If the addition of ammonia has too far exceeded the neutralisation point, it will only result in an unnecessarily large amount of iron being precipitated. When analysing several steels of similar composition a fixed amount of ammonia may be added, which ensures complete separation of the uranium, and only a very slight separation of the iron, thus increasing the rapidity with which future precipitations will be effected. The precipitate is filtered off and washed without delay, as it is capable of clinging tenaciously to the sides of the beaker if allowed to stand. Dilute, warm, hydrochloric acid is poured over the filter repeatedly until the precipitate has dissolved, the liquor being collected in a 20 oz. beaker. The paper is washed with hot water until the washings, on testing, are free from acid salts.

About two grams of sodium persulphate are added to the beaker and the solution boiled, which peroxidises and precipitates the iron and manganese. Five to ten grams of sodium carbonate and an excess of ammonium carbonate are then added, and the boiling continued. The ammonium carbonate is added with the purpose of keeping uranium in solution. After settling, the precipitate is filtered off and washed with water containing a little ammonia, and ammonium carbonate. Dilute hydrochloric acid is then added to the filtrate with constant stirring in such quantity that the solution remains only faintly alkaline.

An Indicator

FOR an indicator turmeric paper is most suitable, as it is dark red brown in alkaline solutions and turns yellow in acid liquors. It is added here and should be changed to a faint yellow colour, although the liquor is still slightly alkaline. Acetic acid is then added in sufficient quantity to make the liquor distinctly acid. The addition of hydrochloric acid is made with a view to economy, as otherwise a very large excess of acetic acid would be required. The liquor is boiled till free from carbon dioxide, and the hot solution titrated with a weak standard sodium phosphate solution, using potassium ferrocyanide indicator. 2·984 grams of sodium hydrogen phosphate are made up to a litre with water, 1 c.c. corresponding to ·002 gm. uranium. The titration at this point can only be applied if the metal is an almost pure uranium steel.

If chromium or vanadium are present the estimation requires to be altered as follows: Dilute hydrochloric acid is added to the filtrate until it becomes slightly acid, and the carbon dioxide boiled off as before. An excess of ammonium phosphate crystals are added, and when dissolved the solution is made alkaline with ammonia. Acetic acid is added in sufficient quantity to reacidify the liquor, and then an excess of about 5 c.c. poured in. Vanadium and chromium are kept in solution by means of the acetic acid.

After settling for some time the precipitate of uranium phosphate is filtered off and washed with dilute acetic acid containing a few drops of ammonium phosphate. The precipitate is then redissolved by pouring hot dilute sulphuric acid (50 per cent.) over the filter paper. As small quantities of the precipitate adhere firmly to the paper sometimes, it is advisable to wash the filter repeatedly with dilute sulphuric acid, after the main bulk of the mass has dissolved. A few drops of hydrogen peroxide are added to the liquor which will develop a brown colour if any vanadium still remains, in which case a reprecipitation with ammonium phosphate will be necessary. When no colour develops, the solution is made alkaline with ammonia, acidified with acetic acid, boiled and the hot liquor titrated with standard phosphate solution, using ferrocyanide indicator as previously stated. It might be mentioned in conclusion that many characteristic tests can be made for vanadium besides the well-known hydrogen peroxide method. For example, the series of changes in colour produced by the addition of metallic zinc could be made use of, also the green precipitate produced by potassium ferrocyanide which is insoluble in acids, both of which are thoroughly reliable for distinguishing this element.

Non-Magnetic Cast-iron

A FORM of non-magnetic cast iron was described at the May meeting of the Lancashire branch of the Institute of British Foundrymen, by Mr. S. E. Dawson. This product has many possible uses in electrical work, where it may be employed for cable bushes, switch covers, busbar clamps, sealing bells, terminal supports, generator and motor end plates, insulator carriers and so on.

MR. DAWSON explained that Osmond, Guertler, and others have shown that in a steel the critical change temperature from the non-magnetic to the magnetic state is lowered to about 200° C. when the nickel content is raised to 30 per cent., while under conditions of slow cooling both austensite and martinsite may exist, both containing nickel in solid solution. They found also that manganese acts somewhat similarly but with about double the effect per cent. present. In order to produce a non-magnetic cast iron it is necessary to select as additional elements those which prevent or retard the change-point to the greatest degree. This effect will also be very much different and perhaps more intense in the case of cast iron due to the effect of "impurities." If we consider, for example, the addition of nickel to steel about 25 per cent. would be required to produce the austensite condition for low-carbon steels, and about 12 per cent. of manganese is required to have the same effect. We should expect, then, in combination that the effect would be produced by percentages which would total up to the equivalent of 25 per cent. nickel.

In addition to its mechanical advantages, non-magnetic cast iron combines high resistance with low temperature coefficient to an exceptional degree.

Trade, Commerce, Finance: The Month in Review

From Our Northern Correspondent

THE conditions prevailing during the past month have not warranted any optimistic view of the iron and steel trade. Everywhere the published reports are gloomy, and conversation with the manufacturers and merchants only confirms the depression. It almost looks as though last year's experience is to be repeated. The industry seems to be slipping back from the improved position which it reached in the beginning of the year, an atmosphere of dullness characterises the markets and the Exchanges, and there is no confidence in the immediate future. The general feeling is that nothing better can be expected before the autumn. The Whitsuntide holidays have, as usual, reduced the amount of business transacted, especially in the Lancashire district, and it is possible that this holiday spirit will have its effect throughout the next month or two. One realises now what the railway orders have meant to the country.

Trade Depression

There are so many contributing factors to this depressed state of trade that it is difficult to put the finger on any special cause or cure. Naturally they are all a more or less direct result of the war. The long continuance of the unsettled conditions in Europe has had a slow but cumulative effect, and it is hoped that the change of Government in France will hasten a recovery. The French policy in the Ruhr has been definitely proved a failure, and the sooner it is abandoned the better. It is no use looking for a normal flow of trade until the international relations are restored to something like order.

Then there is the shortage of capital which is so acute, and which is hampering trade. Many concerns are working on borrowed money, and each week brings its tale of those who are unable to carry on any longer. It is indeed a weeding-out of the unfit and ill-equipped, and we are afraid that many more will go down before the turn in trade comes. In Lancashire the effect of this shortage of capital is more pronounced than elsewhere. There is urgent need of replacement of machinery and plant all round. There is sufficient work in boilers alone to keep the boiler makers busy, but the money is not there to permit of its being given out. In the meantime, the cotton trade is bad, and the prospects of accumulating funds are not bright.

Increased Productive Capacity

Another factor which must be considered is the largely increased productive capacity of the country, which is the result of the lavish expenditure on new plant encouraged by the Government a few years ago. That alone is a deterrent to healthy trade. It is impossible for ordinary requirements to keep the whole of the enlarged plants fully at work, consequently every new order is subject to keen competition among the various works; and unfortunately this competition is not limited by the cost of manufacture. Orders are being taken at prices which do not cover overhead charges, but the alternative is closing down the mills for want of orders. At the same time this competition is carried to extremes. We know that one firm, if not more than one, is actually selling boiler plates at £2 per ton below the official market price. There is no sense or reason in such a course. The plate trade is especially precarious at present, the market price of ordinary plates being well under cost, but boiler plates do offer a margin of profit, and it is difficult to see what justification there can be for cutting the price of these to such an extent.

The same policy is obtaining in other branches of the industry. Steel sections which not long ago stood at £10 per ton are now being sold at £9 10s., or even less, not because there is any reduction in the cost of manufacture, but simply because of the competition for orders among the firms, whose large plants must be kept working. And even then, the orders are not sufficient to go round.

It is therefore not surprising to hear that first in one quarter, then in another, mills and furnaces are being closed down. The Blaenavon Co. have put their two furnaces out of blast: Messrs. Dorman, Long and Co. have closed down their Acklam rolling mills; Messrs. Steel, Peech and Tozer are working a much smaller number of furnaces than they were a short time ago. We are going through a settling-down period, and when it is over it will be found that more than one old landmark has disappeared.

Higher Prices or Lower Costs

The alternative to higher selling prices is lower production costs, and the one seems about as remote as the other. The cost of fuel and the attitude adopted by Labour make vain any hope of reduced costs. It cannot be too often repeated that coal and coke are far too dear to allow the steel trade to make any headway. At the recent meeting of the coke makers and iron masters the price of coke was actually advanced to 25s. at the ovens, but in view of the determined opposition of the iron masters the price was allowed to remain at the old level of 24s. The proposed advance was altogether uncalled for. The recent acute shortage of coke has completely disappeared, and supplies are now in excess of works requirements, owing to the cessation of the export of coke. It is now the turn of the blast furnace owners to regulate supplies, and some of the coke makers will find that the utterly selfish policy which they adopted for many months will come back on them.

Coal is also easier at the moment, but it is doubtful whether any really effective reduction in price will be made. The colliery owners quote the increase in wages as a reason for maintaining prices, but in some districts, particularly South Yorkshire, the published accounts show that there is ample margin in profits to cover this increase. The steel trade will do no good until coal is down below 20s.

Demands for higher wages in the steel works are still to the fore. The obvious method of getting higher wages without crippling the industry — longer working hours or more efficient work in the shorter time—does not readily commend itself to the men. The habit of getting the maximum pay with the minimum of effort, another war legacy, has not been eradicated, nor will it be except by sheer necessity. There are all the elements present for a stiff fight between the employers and the men. We can only hope that the negotiations which are now proceeding between the two parties in the various branches of the iron and steel trades will result in an agreement which will assist, or at least not retard, the revival of trade, which, after all, is the surest guarantee of better wages.

Iron and Steel Production

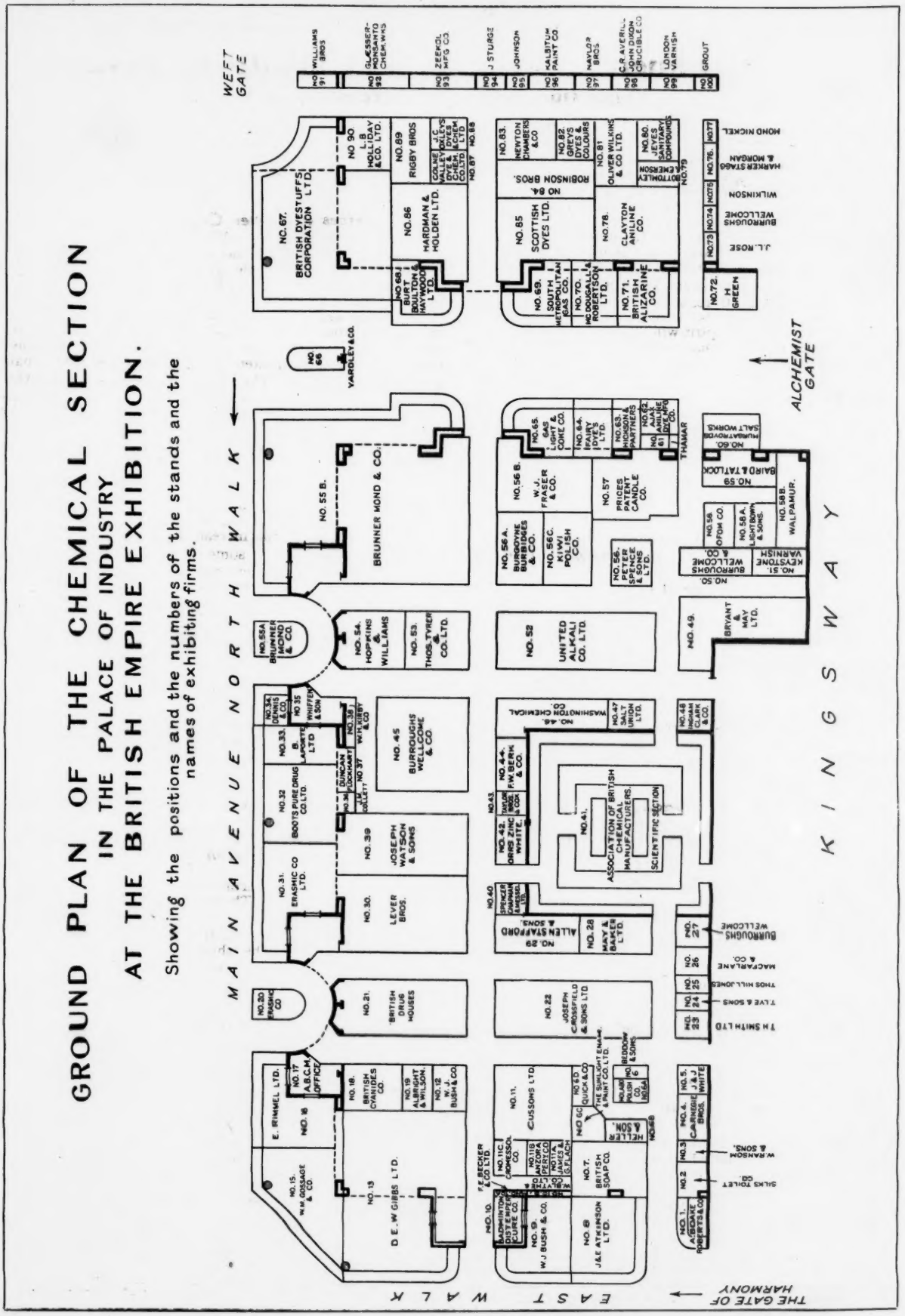
Iron and steel production in April was below the level of March, and it is almost certain that the figures for May will show a further decrease. The contracts placed by the railway companies are being worked out, and new orders are not coming in fast enough to replace them. There is a slightly better demand from the shipbuilding yards, which may develop. Some of the special industries are quite busy. Thin sheets are about the best market at present, and practically all the mills in this class of work are busy. The motor car steels are also still in good demand. There is much apprehension as to the result of the withdrawal of the McKenna duties, although one feels that much more has been made of this than the situation actually warrants.

The main feature is that buyers lack confidence, and so long as they are in that attitude there will be no business of any magnitude passing. It is probable that a considerable volume of business is accumulating which will eventually be placed, but at present a hand to mouth policy is being followed. Continental competition is a little more active, but is not particularly marked owing to the disturbed position on the Continent. Deliveries are coming in better against old contracts, but it will take a little time to restore confidence on that point.

Pig iron has been a dull market in the past month, and there has been a tendency for prices to ease. Makers have insisted that costs would not permit of any further reductions, but orders have been taken at 1s. to 1s. 6d. below the price ruling in April. There have been no appreciable quantities

GROUND PLAN OF THE CHEMICAL SECTION
IN THE PALACE OF INDUSTRY
AT THE BRITISH EMPIRE EXHIBITION.

Showing the positions and the numbers of the stands and the names of exhibiting firms.



bought, indeed, the past week or two have been particularly slack. The coke situation is still a decisive factor. The price is fixed until the end of June. At the end of that period pig iron makers will certainly demand a reduction. Meanwhile pig iron purchases are restricted to current needs.

Steel billets have also weakened, but here again there is not much buying. The hard billets and acid qualities have had a better showing, but soft billets are quiet. There has not been much Continental material bought, although Belgian prices are considerably lower than ours. The re-rollers in the Midlands are just now congested with heavy deliveries from the Belgian works. There is not much change to report in steel or iron bars. Small steel bars are being sold at £10 per ton or less, but they are still about £2 above the Belgian prices.

Competition for orders for heavy plates continues acute, and buyers find no difficulty in obtaining reductions on the official price of £10 5s. Orders will be accepted at £10 2s. 6d., and we have heard of sales at less than £10. Orders, however, are somewhat scarce.

Recent Contracts

There have been some notable contracts placed during the month, which should directly benefit the iron and steel trades.

Messrs. Vickers have secured an order for a 7,000 ton steamer for the Furness Withy Warren line, and Messrs. Pickersgill and Sons, of Sunderland, have an order for a monitor type vessel of 7,500 tons.

Messrs. Ruston and Hornsby have received orders for six of their mammoth dragline excavators for India, valued at about £130,000.

It is also reported that an order for thirteen miles of welded steel pipes for the new water supply scheme for Singapore has been secured by a well-known Glasgow firm.

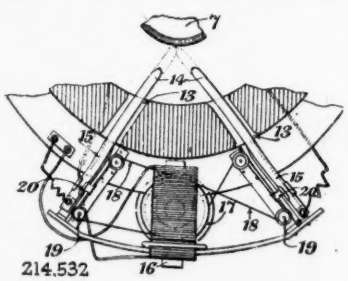
It is interesting to record that Messrs. Edgar Allen and Co. received an order from the Glasgow Corporation for tramway track work in competition with the United States Steel Products Co., although the Sheffield price was £500 higher than the American.

Some Inventions of the Month

By Our Patents Correspondent

Electric Furnaces for Melting Metals

AN electric furnace suitable for melting steel, bronze, etc., has been patented by L. Lombardi, of Rome. The furnace, which is of vertical cylindrical shape, is supported on a platform provided with a segmental toothed rack, so that it may be tilted by means of a pinion for pouring the metal. The electrodes 14 are supported in guideways 15, and project through openings 13 in the cylindrical wall of the furnace.



The electrodes are arranged in pairs as shown, inclined at an acute angle, and an electromagnet 16 is arranged between these electrodes to deflect the arc against the wall of the crucible 7. An endless belt 18 is secured to the electrodes by clamps 20, and passes round rollers 19 and a pulley 17. If the latter is rotated by a handle, the electrodes may be adjusted towards or away from one another. The electric current may have as many phases as there are pairs of electrodes, *e.g.*, 3, and passes first through the coil of each magnet, then through the electrodes, and then to a netural point. See Patent No. 214,532, dated August 14, 1923.

Alloys

A PROCESS for obtaining hard alloys suitable for tools is the subject of two patent applications by General Electric Co., Ltd., of London (Assignees of Patent-Treuhand-Ges. fur Elektrische Gluhlampen of Berlin). In the first application, these alloys contain 95·5 to 97 per cent. of tungsten, and 3 to 4 per cent. of carbon and have a homogeneous microcrystalline structure. Some or all of the tungsten may be replaced by molybdenum or chromium, and some or all of the carbon by boron, titanium, or silicon. To obtain the alloys, material rich in carbon is heated in an arc in a carbon-free atmosphere, or under reduced pressure, or by melting a low-carbon material in coal-gas, methane, or carbon monoxide. The molten material is rapidly cooled by stopping the arc, or pouring the product into a mould.

In the second application, tungsten carbide is obtained by carbonising tungsten powder by carbonaceous gases or solid carbon, and the carbide, which contains 3-10 per cent. of carbon is combined with up to 10 per cent. of iron, nickel, or cobalt. The alloy is pressed into the required shape, and sintered in non-oxidising gas or embedded in carbon or graphite. See Specifications No. 213,214, 213,524, having the International Convention dates, March 21 and 29, 1923.

An alloy capable of withstanding high temperatures in air without excessive oxidation has been patented by the British Thomson-Houston Co., Ltd., London. (Communicated from The General Electric Co., New York.) The alloy is for electric resistance heating purposes, and consists of iron containing 15–35 per cent. of chromium and 5–12 per cent. of aluminium. The physical properties of the alloy may be improved by adding about 1 per cent. of titanium, zirconium, molybdenum, uranium, vanadium, etc. The alloy may be forged or drawn into wire, and it has sufficient tensile strength to be used for making articles such as annealing boxes, furnace structures, etc. The resistivity and durability increase with the aluminium content, but the ductility decreases. The temperature coefficient of the alloy is practically zero, and the alloy is only slightly oxidised by prolonged heating above 1,000° C. The basic metal may be iron or low carbon steel, *e.g.*, containing 0·02 per cent. of carbon, 0·04 per cent. of sulphur, 0·03 per cent. of phosphorus and 0·15 per cent. of silicon. The alloy is made by melting the iron and chromium, and adding them to the molten aluminium. The latter and the aluminium should be covered with cryolite slag to protect them from oxidation, and when casting the alloy the moulds are dusted with cryolite to dissolve the oxide film. See Patent No. 215,231, dated August 1, 1923.

An application has been made by G. and E. Stig, of Hardanger, Norway, for a patent for iron and steel alloys containing manganese, chromium, etc., low in carbon and silicon. An ordinary alloy is bessemerised, the blowing being interrupted when the carbon is sufficiently reduced. The product containing 0·15 per cent. of silicon is pulverised, and briquetted with powdered metallic oxides and the briquettes added to molten iron or steel. See Patent Application No. 213,568, having the International Convention date, March 27, 1923.

Modifying the Physical Character of Metals

A PROCESS for treating metal to convert it into a single crystal (as used in tungsten electric lamp filaments) is the subject of a patent application by Metallbank und Metallurgische Ges., Frankfurt-on-Main, Germany. The metal is stretched at the lower re-crystallising temperature, *e.g.*, 250°–500°C. for aluminium or 20°–100° C. for tin. The temperature is then raised to a higher re-crystallising temperature, *e.g.*, 600°–650° C. for aluminium or 200°–230° C. for tin. Metal of this structure has different physical properties in different directions. See Patent Application No. 213,575, having the International Convention date, March 31, 1923.

Vapour Pressures of Metallic Chlorides

EXPERIMENTAL work has been completed by the American Department of the Interior through the Bureau of Mines, which accurately determines the vapour pressures and heats of vaporisation of various metallic chlorides at high temperatures. This information was needed in the Bureau's experimental work on volatilisation methods of treating complex ores, and the results should be useful to all commercial plants employing such methods.

Current Articles Worth Noting

We give below a brief index to current articles in the technical press dealing with metallurgical subjects.

ALLOYS.—Molybdenum, its alloys and its applicability as an alloying constituent. P. Powell. *Brass World*; Part II, April, 1924, pp. 117–123; Part III, May, 1924, pp. 157–162.

Duralumin, its properties and its field of application R. Beck. *Z. Metallkunde*, April, 1924, pp. 122–127 (in German). Gives a comprehensive description of its historical evolution, properties, methods of improvement and present-day application.

The light metals in alloys. F. Regelsberger. *Z. angew. Chem.*, April 24, 1924, pp. 235–239 (in German). Discusses alloys containing alkali and alkaline earth metals magnesium, beryllium and aluminium.

ELECTRO-PLATING. Studies on electro-plating. Part III. Addition agents. W. E. Hughes. *Metal Ind. (Lond.)*, May 2, 1924, pp. 417–419. The use of addition agents in practice.

Recent advances in electro-plating. *Chem. Met. Eng.*, May 12, 1924, pp. 753–755. Nickel deposition and the electro-plating of steel with zinc.

CORROSION. The electrochemical character of corrosion. Part IV. U. R. Evans. *Brass World*, April, 1924, pp. 125–128. Experimental demonstration and general conclusions.

The corrosion of copper and copper alloys. U. R. Evans. *J.S.C.I.*, May 2, 1924, pp. 127–131T. Analyses the causes of localised corrosion in copper and brass articles.

First (experimental) report to the Atmospheric Corrosion Research Committee (of the British Non-Ferrous Metals Research Association). W. H. J. Vernon. *Trans. Faraday Soc.*, March, 1924, pp. 839–934. This report is concerned, in the main, only with the phenomenon of tarnishing and embodies the results of (1) tests carried out with relatively large specimens exposed to representative atmospheres, with the primary objects of comparing the effects of these atmospheres upon typical metals and alloys and correlating their behaviour, and (2) laboratory experiments conducted upon relatively small specimens with the object of obtaining information concerning the mechanism of atmospheric corrosion.

Chromium-plating steel. Investigation of this remarkable protection against corrosion. K. W. Schwartz. *Chem. Met. Eng.*, April 21, 1924, pp. 627–628.

IRON AND STEEL.—Influence of chemical composition on cast iron. *Metal Ind. (Lond.)*; Part V, May 2, 1924, pp. 431–432; Part VI, May 9, 1924, pp. 455–457. Concludes the discussion of the influence of carbon.

The use of oxygen and air enriched with oxygen in the production of pig iron. R. Schenck. *Stahl u. Eisen.* May 8, 1924, pp. 521–526 (in German). The reactions in the blast furnace and the influence thereon of increased oxygen concentration; review of literature.

Progress in electric steel production. F. Somer. *Stahl u. Eisen*; Part I, May 1, 1924, pp. 490–496; Part II, May 8, 1924, pp. 526–530; Part III, May 15, 1924, pp. 553–558 (in German). Statistics; electric arc and induction furnaces; economical and metallurgical aspects.

Metalloids in basic pig iron in basic open-hearth practice. Part III. C. L. Kinney. *Blast Furnace and Steel Plant.* May, 1924, pp. 220–224 and 258–259. Data showing the losses sustained when unnecessary quantities of silica or bases are used.

The progress made in blast furnaces. R. Jordan. *Rev. Metallurgie*: Part I, March, 1924, pp. 127–142; Part II, April, 1924, pp. 223–232 (in French).

COBALT AND NICKEL.—Separation of cobalt from nickeliferous ores by the purpureo-cobalt chloride process. G. T. Morgan and J. D. Main Smith. *J.C.C.I.*, May 2, 1924, pp. 131–133T. Outlines a suggested large scale process involving solution of the ore, the removal of arsenic, the formation of the insoluble cobalt compound, and its decomposition to yield cobalt oxide.

Commercial Intelligence

The following are taken from printed reports, but we cannot be responsible for any errors that occur.

Mortgages and Charges

[*NOTE.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described therein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every Company shall, in making its Annual Summary, specify the total amount of debts due from the Company in respect of all Mortgages or Charges. The following Mortgages and Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.*]

BARROW HÆMATITE STEEL CO., LTD.—Registered April 22, mortgage and sub-mortgage to bank, charged on properties at Worsborough, etc. (subject to prior mortgage) and the principal sum of £30,379 charged on properties at Worsborough, etc. (subject to prior mortgage.) *£889,251. April 11, 1923.

COX (JOHN) AND SONS (METALS), LTD., Birmingham.—Registered April 15, charge to bank, charged on 1, Hick Street, Birmingham.

DORMAN, LONG AND CO., Middlesbrough, steel manufacturers.—Registered April 15 (by order on terms), four mortgages dated February 15, 1924 (supplemental to trust deed dated July 26, 1923, securing £3,500,000 debenture stock); charged on properties set out in schedules to the mortgages, being those formerly belonging to Bell Bros., Ltd., Carlton Iron Co., Ltd., Sir B. Samuelson and Co., Ltd., and North-Eastern Steel Co., Ltd. *£3,900,000. January 4, 1924.

DREW-BEAR PERKS AND CO., LTD., London, S.W., ironfounders.—Registered May 2, agreement increasing rate of interest on £5,000 debentures part of £15,000, registered January 25 and March 4, 1904, and August 9, 1905; general charge. *£15,000. December 31, 1923.

NATIONAL STEEL CO., LTD., Tipton.—Registered April 10, £1,100 third debenture, to J. Lees, 411, Hagley Road, Edgbaston, manufacturer; charged on properties at Tibbington, Tipton; also general charge (subject to prior charges). *£6,693 11s. 10d. December 31, 1923.

NEILL (W.) AND SON, LTD., St. Helens, ironfounders.—Registered April 28, £10,000 debenture, to bank; general charge. *£3,600. August 13, 1923.

PORTER TURK AND SON, LTD., Newbury, ironfounders.—Registered May 7, £1,400 mortgage, to building society; charged on 118, Bartholomew Street, Newbury. *£3,700. April 11, 1924.

SMITH AND COVENTRY, LTD., Salford, ironfounders.—Registered April 23, £1,000 debentures, part of £25,000; charged on properties at Salford, also general charge. *£115,000 debentures. October 31, 1923.

TYNDRUM LEAD AND ZINC MINES, LTD., London, E.C.—Registered April 24, £1,970 A debentures, part of £35,000; general charge, *£33,830. January 14, 1924.

Satisfactions

MEYNELL AND SONS, LTD., Wolverhampton, metal founders.—Satisfaction registered May 2, £2,000, part of amount outstanding July 1, 1908.

NORTH WALES IRON AND MANGANESE CO., LTD., Liverpool.—Satisfactions registered April 15, £5,000, registered January 13, 1905, to March 9, 1906, and all moneys, etc., registered November 18, 1921.

PORTER TURK AND SON, LTD., Newbury, ironfounders.—Satisfaction registered May 9, £2,700, registered August 6, 1919.

London Gazette

Companies Winding Up Voluntarily

HAYTOR IRON MINES, LTD. W. E. Secker, Eldon Street House, London, appointed liquidator. Meeting of creditors at the offices of the liquidator, on Thursday, June 12, 1924, 12 noon.

METAL PRESERVING CO., LTD. J. P. McGill, 10, Victoria Street, Liverpool, chartered accountant, appointed liquidator.

THE WENVOE IRON ORE CO., LTD. D. Percy Jones, chartered accountant, Taff Street, Pontypridd, the Secretary of the company, appointed liquidator.

INDEX TO ADVERTISERS

FOR CLASSIFIED INDEX TO TRADES SEE PAGES xxvi & xxvii

INDEX TO ADVERTISERS—*Continued*

FOR CLASSIFIED INDEX TO TRADES SEE PAGES xxiv & xxv

TRADE GUIDE

The Chemical Age

THE Trade Guide is a compact and handy form of reference to a representative list of firms engaged in various branches of the Industry. In most cases fuller particulars may be found by referring to the displayed advertisement elsewhere.

Acids

SULPHURIC
MURIATIC
DIPPING
BATTERY
NITRIC

OLEUM
(all Strengths)
and
SALTCAKE

SPENCER CHAPMAN & MESSEL, Ltd.
86, Mark Lane, E.C.3

Analytical Reagents

B.D.H. CHEMICALS
FOR RESEARCH AND ANALYSIS.
THE BRITISH DRUG HOUSES, LTD.
Makers of Fine Chemicals.
Graham Street, City Road, London, N.1
Chemical Works: Wharf Road, London, N.1
Telegrams: "Tetradome, Telew, London."
Telephone: Clerkenwell 3000 (6 lines).

Chemical Plant

LILLESHALL CO., LTD.
OAKENGATES, SALOP
FILTER PRESSES
& Other Chemical Plant

CENTRIFUGES
Steam, Belt, Electrical, and Water Driven.
For every class of separation.
Write for new Catalogue No. 39
T. Broadbent & Sons, Ltd., Huddersfield.

China Clay

THE CHINA CLAY TRADE REVIEW
Published Monthly in "The Chemical Age" and containing Exclusive Articles on the production and uses of
CHINA CLAY

Deodorising Compound

VIOFLOR (Regd.)
(New Style)
Removes Objectionable Smells in White Spirit, Turpentine Substitutes, Lubricating and Fuel Oils, Greases, Distempers, Glues, &c.
CREPIN & DOUMIN, LTD.
15, COOPER'S ROW, E.C.3

Subscription to "The Chemical Age" is: U.K. £1:1:0 Abroad £1:6:0 including weekly issues of the Journal, The Chemical Age Year Book Diary and Directory and the use of the Enquiry Bureau.

Disinfectants

W. GARDINER & CO.
83 Broad Street, Camlachie, Glasgow
ALL GRADES
Percentages & Co-efficients
Also LIQUID SOAPS

Drums and Tins

JOHN FEAVER, LTD.
TOWER BRIDGE ROAD, S.E.1
TINS
For PRESERVED PROVISIONS and FOODSTUFFS.
CANS for VARNISH PAINT.
DRUMS and TAPERS for Oils, Varnish.
Samples and Prices on Application.

Drying Machines

DRYING MACHINES
Automatic and Continuous
Temperature under Perfect Control
See Advertisement
RICHARD SIMON & SONS, LTD.
BASFORD, NOTTINGHAM

Ebonite

"DEXONITE"
Use it instead of Ebonite.
Acid Alkali & Temperature Proof.
Excellent Non-Conductor.
Dexine Ltd. (Dept. CA)
Abbey Lane, Stratford, London, E.15.
'Phone Maryland 2435.

Evaporators

KESTNER PATENT
EVAPORATORS
ACID ELEVATORS
FANS
EXTRACTORS
CRYSTALLIZERS
Kestner Evaporator & Engineering Co. Ltd
5, Grosvenor Gardens, Westminster, S.W.1.

MULTIPLEX AND SIMPLEX FILM EVAPORATORS.
DISTILLING PLANT.
DRYING PLANT OIL HARDENING PLANT.
BLAIR CAMPBELL & McLEAN LTD GLASGOW
MAKERS OF ALL TYPES OF CHEMICAL PLANT.

Filterpresses

P.F.C. PREMIER FILTERPRESS CO. LTD.
THE RESULT OF 60 YEARS EXPERIENCE
FINSBURY PAVEMENT HOUSE, LONDON, E.C.2

S. H. JOHNSON & CO., LTD.,
CARPENTER'S ROAD,
STRATFORD,
E.15.
FILTER PRESSES

WRITE FOR PARTICULARS
of the
TRADE GUIDE SECTION.
IT IS WORTH YOUR WHILE.

TRADE GUIDE

The Chemical Age

THE Trade Guide will undoubtedly be found of great assistance by buyers; should any information be required which cannot be found herein a request to the "Chemical Age" Business Manager will bring a ready response.

Furnaces

Cut your Fuel Costs

By adopting Wilton's (1920 Patt) Furnaces

Oil Burners can be fitted — Write for Booklet

Chemical Eng. & Wilton's Pat. Furnace G. Ltd.
Dept. C.A.F. 19, Victoria St., London, S.W.1 Victoria 2417

General Chemicals

CHEMICALS, FERTILISERS
TAR & AMMONIA PRODUCTS
CHAS. PAGE & CO. LTD.
37/39, KING WILLIAM ST. LONDON, E.C.

RYDING & CO.

MAGNESIUM CHLORIDE
Magnesi o Epsom Salts
Chemicals for all Industries

Trafford Park, Manchester
'Phone: 734 Trafford Park, A B C 5th & 6th Editions
'Grams: "Magchlorid, Manchester"

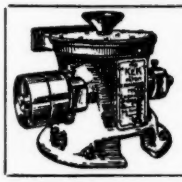
Glass Lined Tanks

Pfaudler

Equipment—
Glass Lined
—the superior containers for manufacturing
Sensitive and Volatile Products

Enamelled Metal Products Corporation, Ltd.,
56, KINGSWAY, LONDON, W.C.2.

Grinding Mills



"KEK"
Patent GRINDING MILL for Chemicals, Colours, Dyes, Minerals, &c.
Sole Makers & Patentees:
The Chemical Engineering Co. (M/cr, Ltd.)
49, Deansgate, Manchester

Instruments

BRISTOL'S
RECORDING
GAUGES & THERMOMETERS
J. W. & C. J. PHILLIPS, Ltd.
23, College Hill, London, E.C.4

Insurance

Pay less

FIRE INSURANCE AND WORKMEN'S COMPENSATION

John Jack & Son
26 Pall Mall, Manchester

Metallurgy

THE METALLURGICAL SECTION
OF
"THE CHEMICAL AGE"
FIRST WEEK IN EVERY MONTH.

Special Articles dealing with STEEL WORKS PROCESSES

Oil and Fuel

ANGLO'S FUEL OIL
for
Steam Raising, Diesel and Semi-Diesel Engines, etc.
ANGLO-AMERICAN OIL CO., LIMITED
36 Queen Anne's Gate, London, S.W.1

Publishers

Essential Books for the Chemical Industries

Write for full particulars to—
ERNEST BENN, Ltd., London

Roofing

ROBERTSON ASBESTOS PROTECTED METAL
Sales Agents:
EDWARD LE BAS & CO.
Dock House
Billiter Street, London, E.C.3.

Steam Fittings

1855 CRANE 1922
Everything for any Pipe Line
CRANE-BENNETT LTD.
45/51, Leman Street, London, E1.
Branches:
MANCHESTER, BIRMINGHAM, LEEDS, GLASGOW.
WORKS: IPSWICH.

Sulphur

PRICE, STUTFIELD & CO., LTD.
6, FENCHURCH BUILDINGS,
LONDON, E.C.3

Sublimed Flowers.
Commercial Flowers. Fine Ground.
Refined Roll. Refined Rock.
Rough—99/99·5% American.

Tower Fillings

PROPELLER TOWER FILLINGS

Economy & Efficiency combined with Strength

John Metham & Sons
Chapel Bridge
MANCHESTER

Valves

Valves for
COMPRESSED GASES
DAVID SCOTT & Co.
Cathkin Engineering Works
Polmadie - Glasgow

YOU

can get your Business Card on every buyer's desk at least once a week at a fraction of a traveller's cost. It is surely worth investigation

Miscellaneous Announcements

1d. per word
minimum 2/-
3 insertions
for price of 2.

The Chemical Age

Sales by Auction, &c.
Semi-displayed
8/0 per Inch
4/6 per Half-inch
Per Insertion.

Machinery, Plant, &c., For Sale

CAST IRON TUBULAR HEATING UNIT Furnace Type, having 88 5 in. tubes, with al fittings.

Electric-driven High Lift Pumps, 733 gallons per minute, 90 ft., 220 volts D.C.

Belt-driven Compressor, 400 c.f. per minute, 40 lbs. w.p.

Three High Pressure Steel Digesters, 12 ft. by 6 ft. dia., ⅝ in. plate.

No. 5 "Cyclone" Disintegrator.

Hollow Roll Film Dryer, complete with all fittings; rolls, 5 ft. by 30 in. dia.

Jacketed Evaporating Pans, 13 ft. by 6 ft. by 1 ft.

Steam-driven Wet Vacuum Pump, 10 in. steam, 14 in. water, 12 in. stroke.

Horizontal Steam Engines by Marshall, cylinder, 7½ in. by 12 in., 9 in. by 12 in. and 11 in. by 14 in.

25 N.H.P. Loco Type Boiler by Marshall, 100 lbs. w.p.; also 8 h.p. ditto.

HARRY H. GARDAM AND CO., LTD., STAINES.

COPPER PANS and Steam Coils made to order. Jacketed Pans for steam, hot-water or gas heating. Prices quoted per return. Repairs to all classes of copper work.—R. W. ANDREWS AND Co., Coppersmiths, 148-150, Pentonville Road, London, N.1.

FILTER PRESSES, good second-hand. Sizes 18 in. to 27 in. Price from £20. Particulars and illustration posted per return.—R. W. ANDREWS AND Co., 148-150, Pentonville Road, London, N.1.

FILTER PRESS by S. H. Johnson & Co., with about 40 wood plates and frames, 38 by 26 in.

Vertical belt driven worm gear double 3 in. Ram Pump, acid resisting metal.

Filter Press with 24 wood plates and frames, 22½ in. square, thorough extraction.

Quotations for new Filter Presses, various sizes.

Copper steam-jacketed Pan with Agitator.

Hydro Extractors with cages from 18 in. to 4 ft. diameter.

J. W. MARTIN, Machinery Merchant, 1, Beech Grove, Richmond Grove, Longsight, Manchester. Telegrams: "Locomotive." Manchester.

LABORATORY FILTER PRESS, complete with gunmetal pump, £11.—R. W. ANDREWS AND Co., 148-150, Pentonville Road, London, N.1. Phone 226 Central.

LANCASHIRE BOILER, by Foster, date 1909, 28 ft. 3 in. by 7 ft. 3 in. Will reinsure for 120 lb. working pressure, complete with mountings. —A. J. MADDICK, 10, Princess Square, Plymouth.

OIL MILL, comprising set 5 rolls, 8 in. by 18 in. kettle 39 in. by 20 in., two hydraulic presses with bar boxes 14 in. by 60 in., pump and valves, all in good condition, very little used.—For full particulars apply A. F. CRAIG & Co., LTD., Paisley.

STOVES FOR DRYING AND HEAT TREATMENT. New principle. Perfectly pure air in stove. Any temperature up to 500 degs. Fah. Low running costs. System can be applied to existing stoves. Also new method of boiling liquids.—G. F. WELLS, Engineer, Bath Street Ironworks, Sheffield.

VERTICAL BOILERS.

THREE Cross Tube Boilers, 14 ft. high by 6 ft. dia., 100 lb. w.p.

One Cross Tube Boiler 12 ft. by 4 ft. 9 in., 80 lb. w.p.

One Vertical Tubular Boiler, 11 ft. 2 in. by 5 ft. 7 in., 90 lb. w.p.

One Hopwood Patent Tubular Boiler, 7 ft. 6 in. by 3 ft. 3 in., 80 lb. pressure.

Two 25 h.p. Locotype, one 8 h.p. ditto, best makers.

New 2 to 15 h.p. 100 lb. pressure, ready.

Other sizes at short notice.

CHARLES D. PHILLIPS, LTD.
Emlyn and Central Engineering Works, Newport, Mon.

Miscellaneous Sales

BLACK OXIDE OF IRON, Zinc Sulphate, Lamp Black, Carbon Black, Naphthalene Balls, Solvent Naphtha, Casein, Sodium Oxalate, Sodium Chlorate, Salammoniac, all grades, Ammonium Sulphate, Epsom Salts, Turkey Red Oil, Ammonia, Mirbane Oil, Tartaric Acid, Naphthionic Acid, H. Acid, Benzidine Base, Alpha Naphthol, Diphenylamine, Metanilic Acid, Dimethylaniline.—Enquiries solicited.—HULSE AND Co., LTD., Chemical Manufacturers, Woodlesford, near Leeds.

Miscellaneous Sales—*continued.*

CHARCOAL, ANIMAL and VEGETABLE, horticultural, burning, filtering, disinfecting, medicinal, insulating; also lumps, ground and granulated; established 1830; contractors to H.M. Government. —THOMAS HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Medikaster, London." Telephone: 3633 East.

COKE.—Furnace Coke, 27s. ton ovens; Breeze, 26s. 6d.; Foundry Coke, 43s. 6d.; Anthracite Washed Beans for Suction Gas Plants, 28s. ton pit; Anthracite Cobbles, 29s. 6d. pit; SemAnthracite (reg.), 25s. 6d.—BUCKLE COLLIERY Co., 100, Hales, Cheltenham.

FOR SALE.—330 by 72 cases hard Wax Candles, 12's and small 12's, 26s. case, f.o.r. Liverpool. Bid wanted for 440 gross English White Whisky Bottles, sound and clean.—GWORDIE WAARD, 115, High Street, Wavertree, Liverpool. Telephone: 1320 Wavertree.

NAPHTHA FOR SALE.—Solvent and Heavy Naphtha, water-white Rubber and Paint. Manufacturers please inquire.—BROTHERTON & Co., LTD., Leeds.

PHOSPHATE ROCK.—North African. A quantity for disposal; ground or unground. Particulars on application.—S. WORTLEY AND Co., 36, Brook Street, Bradford.

4-STAGE Vertical Compressor by Murray, Workman, 12 c. ft. per hour at 2,500 lb. pressure; also a Ditto 3-Stage, 2 c. ft. at 2,000 lb.; both unused.—GROVES AND Co., Engineers, Watford.

VALVES and Cocks, clearance to make room—Dewrances' 10 in. with extending spindle £5; 6 in., £4. 3 in. Spring Relief G.M. parts, 25s.; Gland Cocks, Dewrances', etc., 1¼ in., 6s.; 2 in., 7s. 6d.; 2½ in., 10s.; 3 in., 12s. 6d. Fullway Valves, 1 in. 3s. each All brand new.—DAVID GREEN AND SON, Lytham, Lancs.

Miscellaneous Wants

GRINDING of every description of chemical and other materials for the trade, with improved mills.—THOS. HILL-JONES, LTD., "Invicta" Mills, Bow Common Lane, London, E. Telegrams: "Medikaster, London." Telephone: 3633 East.

MINERAL Residues Wanted. Dumps worked up.—HUGH MOUNTAIN, Aldwych House, Aldwych, London, W.C.2.

Miscellaneous Wants—*continued.*

WANTED.—Copies of THE CHEMICAL AGE dated Jan. 3, 31, Feb. 7, 14, 21, April 10, 17, 1920.—Reply to THE CHEMICAL AGE Office, 8, Bouverie Street, E.C.4.

WANTED.—Quantities sound 40 gn. and 20 gn. Oak Barrels, also 5- and 10-gallon Drums.—Specifications and prices to GWORDIE WAARD, 115, High Street, Wavertree, Liverpool.

WANTED.—Radium Salt, Pure or Residues, Old Applicators, &c.—Apply, HARRISON GLEW, Radium Laboratories, 156, Clapham Road, S.W.9.

Agency Wanted

SCOTTISH DISTRICT.—Agent representing China Clay producers desires change, presents sale restricted to 500 tons monthly. Good connection and knowledge of trade.—Write to Box No. 589, THE CHEMICAL AGE Office, 8, Bouverie Street, E.C.4.

Situation Vacant

WANTED.—Engineer holding degree or equivalent in engineering science, capable of acting as Assistant to Manager of large works abroad; experience in chemical engineering practice preferred, especially with reference to problems of distillation and heat transference. Age 30-35. Salary the equivalent of £1,000 per annum for three years with house and sundry allowances. Applicants should give fullest particulars of training, qualifications and experience.—Write "Z.X." c.o. CHARLES BARKER AND SONS, LTD., 31, Budge Row, E.C.4.

Situations Wanted

CHEMIST, 29. Charge of Toilet manufacturing dept. 3 years General Analyst at Consulting Analyst's laboratory 5 years. Clays a speciality. Seeks situation in any direction.—S. F., 373, Norwood Road, West Norwood, S.E.

YOUNG MAN desires position as Chemical Lecture Preparer. Experienced.—Apply Box No. 588, THE CHEMICAL AGE Office, 8, Bouverie Street, London, E.C.4.

YOUNG MAN, 20, good knowledge inorganic chemistry, requires work in chemical works. Go anywhere, home or abroad.—PAYNE, Moseley House, Rounds Green, Oldbury.

Patents

INVENTORS.—Advice, handbook and consultations free.—KING'S PATENT AGENCY, LTD., 146A, Queen Victoria Street, London, E.C.4. 36 years' references. Director: B. T. King, Registered Patent Agent.

THE Proprietors of the Patent No. 138,924 for Treating Zinc Oxide are desirous of entering into arrangements by way of licence and otherwise on reasonable terms for the purpose of exploiting the same and ensuring its full development and practical working in this country. All communications should be addressed in the first instance to: HASELTINE, LAKE AND Co., Chartered Patent Agents, 28, Southampton Buildings, Chancery Lane, London, W.C.2.

THE PROPRIETOR of British Patent No. 163,719 for "Improvements in and connected with the drying of lignite, peat, turf and the like," desires to introduce his invention to the notice of manufacturers and others with a view to the invention being worked commercially under licence or otherwise.—All communications to be addressed to JENSEN AND SON, Chartered Patent Agents, 77, Chancery Lane, London, W.C.2.